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NAS8-31011

## Volume II

## Part III Appendixes

February 1975

# Tug Fleet and Ground Operations Schedules and Controls

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**MARTIN MARIETTA**

MCR-74-488  
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Volume II

Part III  
Appendixes

February 1975

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**TUG FLEET AND GROUND  
OPERATIONS SCHEDULES  
AND CONTROLS**

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## FOREWORD

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This final report, submitted in accordance with Data Procurement Document number 480 dated June 1974, contract NAS8-31011, is published in three volumes:

Volume I - Executive Summary (DRL MA-04)

Volume II - Part I Final Report (DRL MA-03)

Part II Addenda (DRL MA-03)

Part III Appendixes (DRL MA-03)

Volume III - Program Study Cost Estimates (DRL MF003M)

The content of each volume is shown in the diagram on the following page.

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## TUG FUNCTION DESCRIPTION DATA SHEET

A Tug Function Description Data Sheet is prepared for each block of the Space Tug Functional Flow Diagram.\* This sheet is a summary of basic information regarding the activities performed in its respective functional block. These sheets are catalogued by functional flow block numbers with the reference blocks at the end, and contain the following information:

FUNCTION NO: The number for the block on the Space Tug Functional Flow Diagram.

FUNCTION TITLE: The title of the function block.

FUNCTION OBJECTIVE: Brief statement as to objective of the particular functional flow block.

SITE LOCATION: The launch site where the function is performed, i.e., ETR or WTR, or both.

TIME TO COMPLETE (HRS): Estimate of the time required to complete the particular function. Maximum time implies that time required early in the program when processing the Engineering Model or First Flight Article, minimum time is that time required by experienced personnel later in the Shuttle program.

HAZARDOUS: An indication of whether the particular operation is categorized as hazardous. An explanation of any hazardous operation is explained under the "REMARKS" section of the data sheet.

AREA LOCATION: Identification of the building, facility, or area where the activities required by the function will be performed, i.e., Orbiter Landing Field (OLF), Orbiter Processing Facility (OPF), Tug Processing Facility (TPF), Spacecraft Processing Facility (SPF), Payload Changeout Room (PCR), Orbiter (ORB) or any other location noted.

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\*Shown in subplan A, Volume II, Part I.

PERSONNEL (HEAD COUNT): An estimate of the number of personnel and skills required to complete the requirements of the particular function. A number followed by an asterisk (\*) indicates the personnel required to perform the function on the Engineering Model when different from the operational number. A number followed by two asterisks (\*\*) indicates the personnel required to perform the function on the First Flight Article when different from the operational number. The numbers without asterisks are the number of personnel required to perform the function in the operational phase of the Tug program.

GROUND SUPPORT EQUIPMENT: Identification of the GSE required to complete the function. GSE are identified by a unit identification number which corresponds to a specific piece of GSE further identified and defined on a Tug GSE Requirements Specification Data Sheet.

TUG INTERFACE: Identifies any Tug interfaces, i.e., Orbiter, Spacecraft, facility, or software that are necessary to accomplish the function.

TUG ORIENTATION: Describes the physical orientation of the Tug, i.e., vertical or horizontal, during the accomplishment of the function.

PROCEDURES: Tug turnaround activities will be accomplished through the use of checklists rather than traditional lengthy procedures used for one on few-of-a-kind launches. This is an estimate of the number of technical pages contained in the checklist, the manhours to prepare these pages, an estimate of the number of changes made, and the manhours to incorporate these changes.

SOFTWARE REQUIREMENTS: Identification of checkout software necessary to complete requirements of the particular functional block, i.e., LPS program, Orbiter on-board computer program, Tug on-board computer program, ground control station program.

OPERATIONS: A brief descriptive synopsis of the activities performed to accomplish the function.

REMARKS: Comments regarding safety, operational constraints, pre-requisites, or other pertinent information about the function.

COMMODITIES/CONSUMABLES REQUIRED: Identifies the type and amount (pressure, flow rate, etc.) of commodities (helium, nitrogen, power, etc.) required to support the accomplishment of the function.

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 1.1		FUNCTION TITLE: Remove Payload and Install on Transportation Dolly	
FUNCTION OBJECTIVE:  Install Payload on Transporter			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>7</u> MIN <u>3</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input checked="" type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH <u>4</u> AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		HAZARDOUS YES <u>x</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) H-018, H-024, H-025, H-005 _____ _____ _____	
TUG INTERFACE: ORBITER <input checked="" type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
		PROCEDURES PAGES <u>7</u> MANHOURS <u>42</u>	
		NEW <u>4</u> <u>12</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Monitor P/L Bay for toxic vapors and proper oxygen content before entry. Attach P/L handling/hoisting equipment, release Orbiter attachment latches and hoist payload from bay. Lower payload onto transporter and latch in place. Remove handling sling. Inspect payload for any hazardous conditions. Remove flight recorder if equipped.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED: N/A			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: <b>1.2</b>		FUNCTION TITLE: <b>Remove Spacecraft</b>	
FUNCTION OBJECTIVE:  <b>Demate Spacecraft and Tug</b>			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>6</u> MIN <u>3</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input checked="" type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____		HAZARDOUS YES <input checked="" type="checkbox"/> NO _____	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH <u>2</u> AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-019, H-026</u> <u>A-001</u> _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
SOFTWARE REQUIREMENTS: <u>N/A</u> LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES <u>12</u> MANHOURS <u>72</u>	
		NEW <u>6</u> <u>18</u>	
OPERATIONS:  <b>Position workstands around S/C and attach S/C handling equipment. Mechanically demate S/C and Tug. Hoist and move S/C away from Tug. Install transportation cover over Tug.</b>			
REMARKS:  <b>Spacecraft recovery mission only</b>			
COMMODITIES/CONSUMABLES REQUIRED: <u>N/A</u>			

# TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 1.3		FUNCTION TITLE: Remove COMSEC Equipment	
FUNCTION OBJECTIVE: Remove classified LRU's			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX 2 MIN 1	
AREA LOCATION OLF <input type="checkbox"/> OPF <input checked="" type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER 2 TEST CONDUCTOR TEST ENGINEERS 1 PROPULSION TECH MECH/STRU/TH TECH AVIONICS TECH 1 SAFETY ENGINEER QUAL CONT. TECH TECHNICAL SUPPORT	
		HAZARDOUS YES _____ NO x	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) H-026	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input type="checkbox"/>	
		PROCEDURES PAGES 4 MANHOURS 24	
		NEW 2	
		CHANGE 6	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS: Position work platform, remove access door and remove COMSEC LRU. Deliver LRU's to DOD security.			
REMARKS: Secure DOD missions only, requires secured area for removal.			
COMMODITIES/CONSUMABLES REQUIRED: N/A			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 1.4		FUNCTION TITLE: Move to Tug Processing Facility Airlock	
FUNCTION OBJECTIVE:  Transport Tug to Tug Processing Facility (TPF)			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>6</u> MIN <u>4</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORS <input type="checkbox"/> <u>Transport</u>		HAZARDOUS YES <u>x</u> NO <u>      </u>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>2</u> TEST CONDUCTOR <u>      </u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>      </u> MECH/STRU/TH TECH <u>      </u> AVIONICS TECH <u>      </u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>      </u> TECHNICAL SUPPORT <u>      </u>		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>Prime Mover, H-001</u> <u>H-024</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
PROCEDURES		NEW PAGES <u>6</u> MANHOURS <u>36</u>	CHANGE <u>3</u> <u>9</u>
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Attach Prime Mover to Transporter and move from OPF to TPF airlock area. Remove Transportation Cover, visually verify Tug in safe condition. Attach handling GSE and rotate Tug to vertical. Position Tug in Tug workstand and remove access panels.			
REMARKS:  Hazardous due to transportation.			
COMMODITIES/CONSUMABLES REQUIRED: N/A			



## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 1.4A		FUNCTION TITLE: Move to TPF C/O Cell	
FUNCTION OBJECTIVE: Transport Tug to TPF and install in checkout cell			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX _____ MIN <u>4</u>	
HAZARDOUS YES <u>x</u> NO _____			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>2</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>Prime mover, H-001, H-024</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
		PROCEDURES PAGES <u>6</u> <u>3</u> MANHOURS <u>36</u> <u>9</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Attach Prime Mover to transporter and move from OPF to TPF. Remove transportation cover and visually verify Tug in safe condition. Attach handling GSE and rotate Tug to vertical. Position Tug in workstand. Wipe down area around access panels and Tug/adaptor interface area. Remove access panels.			
REMARKS:  Hazardous due to transportation and hoisting Factory clean processing			
COMMODITIES/CONSUMABLES REQUIRED:  Cleaning chemicals			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 1.5		FUNCTION TITLE: Safe and Remove Unexpended Ordnance	
FUNCTION OBJECTIVE:  Remove unexpended and expended ordnance items			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX 4 MIN 2	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER 5 TEST CONDUCTOR _____ TEST ENGINEERS 1 PROPULSION TECH 2 MECH/STRU/TH TECH _____ AVIONICS TECH 1 SAFETY ENGINEER 1 QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		HAZARDOUS YES <input checked="" type="checkbox"/> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY)  As required.	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES 12 MANHOURS 72	
		NEW 6 18	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Safe ordnance mechanically, inspect ordnance, remove unexpended igniters/ ordnance. Remove expended ordnance and cap leads.			
REMARKS: Use LPS to electrically safe ordnance. Required only if Tug requires ordnance.			
COMMODITIES/CONSUMABLES REQUIRED:  N/A			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 1.6		FUNCTION TITLE: Drain and Purge APS	
FUNCTION OBJECTIVE:  Remove all liquid from APS			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>6</u> MIN <u>3</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>  _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>2</u> MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____ _____	
		HAZARDOUS YES <u>x</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>P-011, P-016, A-001, A-008</u> _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input checked="" type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>4</u> MANHOURS <u>24</u>	
		NEW <u>3</u> <u>9</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Connect APS servicing unit, remove propellant from Tug system using Tug pressure system. Drain all lines. Pressurize fluid lines and fluid side of tank to $3 \pm 1$ psig and cap system.  Tag system indicating system condition.			
REMARKS: Requires protective clothing during propellant unloading			
COMMODITIES/CONSUMABLES REQUIRED:  GSE power			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: <b>1.7</b>		FUNCTION TITLE: <b>Remove Flight Batteries</b>	
FUNCTION OBJECTIVE: <b>Remove Flight Batteries for Refurbishment</b>			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>2.5</u> MIN <u>1</u>	
HAZARDOUS YES _____ NO <u>X</u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>4</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH <u>2</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-021</u> _____ _____			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES		NEW PAGES <u>4</u> MANHOURS <u>24</u>	CHANGE <u>2</u> <u>6</u>
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  <b>Disconnect flight battery from Tug power system, release hold down and remove battery.</b>			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED: <b>N/A</b>			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 1.8		FUNCTION TITLE: Connect LH <sub>2</sub> Ground Vent & Dump Lines	
FUNCTION OBJECTIVE:  Prepare Tug for dump and vent of LH <sub>2</sub>			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>1.0</u> MIN <u>.5</u>	
HAZARDOUS YES <u>X</u> NO _____			
AREA LOCATION OLF <input checked="" type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>3</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH <u>1</u> AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY)  <u>P-001</u>			
TUG INTERFACE: ORBITER <input checked="" type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
PROCEDURES		NEW	CHANGE
PAGES _____			
MANHOURS _____			
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Spot Aft Umbilical Servicing Unit near Tug and extend boom. Mate interface plate with Orbiter T-0 Umbilical Plate.			
REMARKS: Orbiter procedure. Hazardous because of propellant in bay.			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 1.9		FUNCTION TITLE: Boil-off and Burn LH <sub>2</sub>	
FUNCTION OBJECTIVE:  Remove LH <sub>2</sub> from Tug Tank			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>7</u> MIN <u>4</u>	
HAZARDOUS YES <u>X</u> NO <u>      </u>			
AREA LOCATION OLF <input checked="" type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>3</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/ST/RU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>P-001</u> _____ _____ _____			
TUG INTERFACE: ORBITER <input checked="" type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
PROCEDURES		NEW	CHANGE
PAGES		_____	_____
MANHOURS		_____	_____
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Permit main propulsion system and fuel cell LH <sub>2</sub> to boil off and vent through burn stack of Aft Umbilical Servicing Unit. Monitor Tug propellant tank pressures.			
REMARKS:  Orbiter procedure. Hazardous because of propellant in bay.			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 1.10		FUNCTION TITLE: Purge LO <sub>2</sub> Tanks and Lines	
FUNCTION OBJECTIVE:  Verify no liquid remains in LO <sub>2</sub> tank.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>4</u> MIN <u>2</u>	
AREA LOCATION OLF <input checked="" type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>3</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		HAZARDOUS YES <u>X</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) _____ _____ _____	
TUG INTERFACE: ORBITER <input checked="" type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
		PROCEDURES PAGES <u>3</u> MANHOURS <u>18</u>	
		NEW CHANGE <u>2</u> <u>6</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Using Tug on-board Helium supply, purge LO <sub>2</sub> tanks. Monitor tank pressures. Stop purge when concentration level begins to decrease. Vent to <u>TBS</u> psia and lock up.			
REMARKS:  Hazardous because of propellant in bay. Done concurrently with LH <sub>2</sub> venting.			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 1.11		FUNCTION TITLE: Purge LH <sub>2</sub> Tanks & Lines	
FUNCTION OBJECTIVE:  Verify no LH <sub>2</sub> remains and reduce H <sub>2</sub> gas concentration level.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>4</u> MIN <u>2</u>	
HAZARDOUS YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>			
AREA LOCATION OLF <input checked="" type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>3</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>P-001</u>			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input type="checkbox"/>	
PROCEDURES		NEW PAGES <u>3</u> MANHOURS <u>18</u>	CHANGE <u>2</u> <u>6</u>
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Using Tug on-board Helium supply, purge LH <sub>2</sub> tanks. Monitor tank pressures. Stop purge when concentration level begins to decrease. Vent to <u>TBS</u> psia and lock up.			
REMARKS:  Hazardous because of concentrated H <sub>2</sub> gas.			
COMMODITIES/CONSUMABLES REQUIRED:			



## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 1.12		FUNCTION TITLE: Verify Tug Systems Safe & Prep to Move	
FUNCTION OBJECTIVE:  Verify propellant/reactant tanks safe, disconnect safing GSE.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>2</u> MIN <u>1</u>	
AREA LOCATION OLF <input checked="" type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		HAZARDOUS YES _____ NO <u>X</u>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>4</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH _____ AVIONICS TECH <u>1</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH _____ TECHNICAL SUPPORT _____		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY)  P-001	
TUG INTERFACE: ORBITER <input checked="" type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input checked="" type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES <u>3</u> MANHOURS <u>18</u>	
NEW <u>2</u>		CHANGE <u>6</u>	
OPERATIONS:  Verify all Tug systems electrically safed and M/S tank pressures at safe level. Vent pressurant tanks to maximum pressure of 1600 psia. Remove Aft Umbilical Servicing Unit.			
REMARKS:  Orbiter systems safing is Orbiter function.			
COMMODITIES/CONSUMABLES REQUIRED:			

# TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 1.13		FUNCTION TITLE: Safe and Remove Ordnance	
FUNCTION OBJECTIVE: Remove ordnance items.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>4</u> MIN <u>2</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>2</u> MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		HAZARDOUS YES <input checked="" type="checkbox"/> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>12</u> MANHOURS <u>72</u>	
		NEW <u>6</u> CHANGE <u>18</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS: Safe ordnance mechanically, inspect ordnance, remove igniters/ordnance.			
REMARKS: Required only if Tug requires ordnance			
COMMODITIES/CONSUMABLES REQUIRED: N/A			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 1.14		FUNCTION TITLE: Service Fuel Cell Cryo Tanks	
FUNCTION OBJECTIVE: Safe System			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>7</u> MIN <u>3</u>	
HAZARDOUS YES <u>X</u> NO <u>      </u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input checked="" type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>   		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>4</u> TEST CONDUCTOR <u>      </u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>2</u> MECH/STRU/TH TECH <u>      </u> AVIONICS TECH <u>      </u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>      </u> TECHNICAL SUPPORT <u>      </u>	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY)  P-002   			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES PAGES <u>4</u> MANHOURS <u>24</u>		NEW <u>4</u> CHANGE <u>2</u> <u>6</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Connect Fuel Cell Servicing GSE - Drain remaining LO <sub>2</sub> , purge LH <sub>2</sub> & LO <sub>2</sub> tanks and lines to verify empty. If fuel cells have been activated, drain H <sub>2</sub> O from system and purge cells to remove moisture. Pressurize fuel cells and reactant tanks and lines to 19 ±1 psia and lock up.			
REMARKS: Hazardous because of reactants.			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 1.15		FUNCTION TITLE: Vent Pressurants to Safe Level	
FUNCTION OBJECTIVE: Vent Tug pressurant to safe work-around level.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>2</u> MIN <u>1</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input checked="" type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		HAZARDOUS YES <u>X</u> NO <u>          </u>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>4</u> TEST CONDUCTOR <u>          </u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>2</u> MECH/STRU/TH TECH <u>          </u> AVIONICS TECH <u>          </u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>          </u> TECHNICAL SUPPORT <u>          </u>		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>P-016</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES <u>3</u> MANHOURS <u>18</u>	
OPERATIONS: Attach GSE, vent Tug Helium spheres to maximum pressure of 950 psia and lock up.		NEW <u>2</u> CHANGE <u>6</u>	
REMARKS: Hazardous because of personnel working around flight pressure. Minimum sphere lock up pressure - 50 psia, LPS to monitor tank pressures.			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: <b>2.1</b>		FUNCTION TITLE: <b>Leak Check Pressurization System</b>	
FUNCTION OBJECTIVE:  <b>Verify Integrity of Pressure System</b>			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>6</u> MIN <u>3</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>2</u> MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES <u>x</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <b>P-011, P-016</b> _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>3</u> MANHOURS <u>18</u>	
		NEW <u>2</u> <u>6</u>	
		CHANGE	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  <b>Verify 3150 ± 50 psi pressure in Tug H<sub>2</sub> spheres (add facility helium as required to reach this pressure). Leak check system (decay) for 30 minutes, maximum leakage TBD psi in 30 minutes. Soap/bubble check all mechanical joints. Retain pressure in system for use during remaining leak checks. Tag system indicating condition.</b>			
REMARKS: <b>Periodic checks of tank pressures will be monitored by LPS. During repressurization clear personnel from area.</b>			
COMMODITIES/CONSUMABLES REQUIRED:  <b>Facility Helium</b>			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: <b>2.2</b>		FUNCTION TITLE: <b>Leak Check LO<sub>2</sub> Tank</b>	
FUNCTION OBJECTIVE:  <b>Verify LO<sub>2</sub> System Integrity</b>			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>7</u> MIN <u>3</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>2</u> MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES, <u>x</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>P-016</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>7</u> MANHOURS <u>42</u>	
		NEW <u>4</u>	
		CHANGE <u>12</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Clear area of personnel, pressurize tank to $31 \pm 1$ psia, stabilize tank pressure for 30 minutes. Open access to essential personnel only. Leak check (decay) tank for 30 minutes, maximum allowable leakage - 1.5 psi in 30 minutes. Soap/bubble check propellant/pressure system mechanical joints. Vent system to $19 \pm 1$ psia and lock up. Tag system indicating condition.			
REMARKS:  Remaining onboard helium used as gas pressure source. Periodic checks of tank pressures will be monitored by LPS. Vent gas external to airlock.			
COMMODITIES/CONSUMABLES REQUIRED:  Facility helium required if Tug helium spheres are empty.			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: <b>2.3</b>		FUNCTION TITLE: <b>Leak Check LH<sub>2</sub> Tank</b>	
FUNCTION OBJECTIVE:  <b>Verify LH<sub>2</sub> System Integrity</b>			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>7</u> MIN <u>3</u>	
HAZARDOUS YES <u>x</u> NO <u>      </u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS _____ PROPULSION TECH <u>2</u> MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____	
GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY)  <u>P-016</u> _____ _____ _____			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES		NEW PAGES <u>7</u> MANHOURS <u>42</u>	CHANGE <u>4</u> <u>12</u>
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  <b>Clear area of personnel, pressurize tank to 32 ± 1 psia, stabilize tank pressures for 40 minutes. Open access to essential personnel only. Leak check (decay) tank for 30 minutes, maximum allowable leakage - 1 psi in 30 minutes. Soap/bubble check propellant/pressure system mechanical joints. Vent system to 19 ± 1 psia and lock-up. Tag system indicating conditions.</b>			
REMARKS: <b>Remaining onboard helium used as gas pressure source. Periodic checks of tank pressure will be monitored by LPS. Vent gas through burn stack.</b>			
COMMODITIES/CONSUMABLES REQUIRED: <b>Facility helium required if Tug helium spheres are empty.</b>			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 2.4		FUNCTION TITLE: Service Fuel Cells and Leak Check Reactant System	
FUNCTION OBJECTIVE:  Service fuel cells for deactivation, drain H <sub>2</sub> O and leak check reactant system.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX 8 MIN 3.5	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		HAZARDOUS YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER 6 TEST CONDUCTOR TEST ENGINEERS 1 PROPULSION TECH 2 MECH/STRU/TH TECH AVIONICS TECH 1 SAFETY ENGINEER 1 QUAL CONT. TECH 1 TECHNICAL SUPPORT		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) P-002	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES 10 MANHOURS 60	
OPERATIONS:  Connect fuel cell servicing GSE, drain H <sub>2</sub> O from system, purge fuel cells to remove moisture and lock up with a blanket pressure of 19 ± 1 psia. Clear area of personnel, pressurize reactant tanks to operating pressure. Stabilize pressure for 30 minutes, open access for essential personnel. Leak check (decay) system for 30 minutes, maximum leakage 3 psi in 30 minutes. Soap/bubble check system mechanical joints. Vent system to 19 ± 1 psia and lock up. Tag system indicating condition.		NEW 5 15	
REMARKS:  Vent gas external to airlock. Periodic checks of system pressure will be monitored by LPS.			
COMMODITIES/CONSUMABLES REQUIRED:  Facility helium required if Tug helium spheres are empty.			



## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: <b>2.5</b>		FUNCTION TITLE: <b>Vent Remaining Pressurant</b>	
FUNCTION OBJECTIVE:  <b>Safe Pressurization System</b>			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>3</u> MIN <u>1</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> RB <input type="checkbox"/>		HAZARDOUS YES <u>x</u> NO _____	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>4</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>2</u> MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY)  <u>P-016</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES <u>5</u> MANHOURS <u>30</u>	
		NEW <u>3</u> CHANGE <u>9</u>	
OPERATIONS:  <b>Connect pressure servicing GSE, vent pressure system to maximum of 950 psia and secure. Tag system indicating condition. Disconnect pressurization and leak check GSE.</b>			
REMARKS: <b>Hazardous due to pressure. Pressurization system pressure periodically monitored by LPS. Minimum helium sphere pressure at lock up - 50 psia. Vent gas external to airlock.</b>			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 2.6		FUNCTION TITLE: Separate Tug from Adapter	
FUNCTION OBJECTIVE: Remove Deployment Adapter from Tug for Maintenance and Refurbishment			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>4</u> MIN <u>2</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>2</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT <u>1</u>	
		HAZARDOUS YES <u>x</u> NO <u>      </u>	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-007</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>5</u> MANHOURS <u>30</u>	
		NEW <u>3</u>	
		CHANGE <u>9</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Position deployment adapter dolly under adapter, attach adapter support arms to adapter at the adapter-orbiter interface attachment fillings. Mechanically demate adapter from Tug intertank skirt and lower dolly support arms. Move adapter for inspection and cleaning.			
REMARKS:  Hazardous due to movement.			
COMMODITIES/CONSUMABLES REQUIRED:			

FUNCTION NO: 2.7		FUNCTION TITLE: Tug Visual Damage Inspection	
FUNCTION OBJECTIVE:  Post flight visual inspection of designated areas for evidence of flight and/or handling damage.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>8</u> MIN <u>4</u>	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>   		HAZARDOUS YES _____ NO <u>x</u>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>7</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>2</u> MECH/STRU/TH TECH <u>2</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-009, H-006</u>   	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES		NEW PAGES <u>6</u> MANHOURS <u>36</u>	CHANGE <u>3</u> <u>9</u>
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Perform a visual damage inspection of S/C adapter, forward skirt and components, helium purge bags, intertank skirt and components, LH <sub>2</sub> main shell, intertank area, engine area. Install protective cover on completion of inspection and work activities.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:  N/A			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 2.8		FUNCTION TITLE: Clean Tug and Prepare to Move	
FUNCTION OBJECTIVE:  Clean Tug to be compatible with class 100,000 cleanliness requirements and prepare for maintenance and checkout			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>12</u> MIN <u>7</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>2</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____ _____	
		HAZARDOUS YES _____ NO <u>x</u>	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY)  H-018 _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>9</u> MANHOURS <u>54</u>	
		NEW PAGES <u>9</u> MANHOURS <u>54</u>	
		CHANGE PAGES <u>5</u> MANHOURS <u>15</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Wipe down Tug with cleaning chemical and vacuum to meet cleanliness requirements. Attach handling equipment for hoisting and disconnect GSE.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED: Cleaning chemical			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 2.9	FUNCTION TITLE: Move into TPF Checkout Area	
FUNCTION OBJECTIVE: Move Tug to 100,000 clean area for maintenance and checkout		
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>	TIME TO COMPLETE (HRS) MAX <u>5</u> MIN <u>3</u>	HAZARDOUS YES <u>x</u> NO <u>        </u>
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>   	PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>2</u> TEST CONDUCTOR <u>        </u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>        </u> MECH/STRU/TH TECH <u>        </u> AVIONICS TECH <u>        </u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>        </u> TECHNICAL SUPPORT <u>        </u>	GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-001, H-026, H-006</u>   
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>
		PROCEDURES PAGES <u>4</u> MANHOURS <u>24</u>
NEW <u>2</u> CHANGE <u>6</u>		
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		
OPERATIONS:  Move Tug from airlock into TPF checkout area, install in Tug workstands, position moveable platforms, remove handling GSE.		
REMARKS: Hazardous due to hoisting operations		
COMMODITIES/CONSUMABLES REQUIRED:		

FUNCTION NO: 2.10		FUNCTION TITLE: Isolate Failed Hardware Causing Mission Anomalies	
FUNCTION OBJECTIVE:  Troubleshoot and identify discrepant components (LRU) which have caused mission anomalies.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>14</u> MIN <u>8</u>	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		HAZARDOUS YES _____ NO <u>x</u>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>8</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>2</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>2</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) <u>as required</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input checked="" type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES <u>6</u> MANHOURS <u>36</u>	
OPERATIONS:  Using flight performance data as an information source, stimulate suspected systems/components to isolate anomalous performance to replaceable LRUs. Tag discrepant units for replacement.		NEW <u>3</u> CHANGE <u>9</u>	
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:  Facility power			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 2.11		FUNCTION TITLE: Scheduled Tug Pre-Maintenance Tests	
FUNCTION OBJECTIVE:  Complete scheduled functional and leak checks			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX 18 MIN 10	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>   		HAZARDOUS YES _____ NO <input checked="" type="checkbox"/>  PERSONNEL (HEADCOUNT) TOTAL MANPOWER 9 TEST CONDUCTOR 1 TEST ENGINEERS 2 PROPULSION TECH 2 MECH/STRU/TH TECH 1 AVIONICS TECH 2 SAFETY ENGINEER _____ QUAL CONT. TECH 1 TECHNICAL SUPPORT _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) A-001, A-002, A-003, A-006, A-007 A-008, A-009, A-010, P-011, P-016  PROCEDURES PAGES NEW 20 CHANGE 10 MANHOURS 120 30	
OPERATIONS:  Install checkout GSE, perform measurement systems end to end calibration. Perform engine leak and functional tests. Leak check purge bag and check for moisture contamination. Leak check APS fluid lines and functionally check system.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED: Helium, GN <sub>2</sub> , Facility Power			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 2.12		FUNCTION TITLE: Scheduled Tug Maintenance and Modification	
FUNCTION OBJECTIVE:  Accomplish scheduled maintenance, inspection and servicing			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>40</u> MIN <u>12</u>	
AREA LOCATION OLF <input type="checkbox"/> CPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>   		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>10</u> <u>17**</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>2</u> <u>3**</u> PROPULSION TECH <u>2</u> <u>3**</u> MECH/STRU/TH TECH <u>2</u> <u>3**</u> AVIONICS TECH <u>2</u> <u>5**</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> <u>3**</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES _____ NO <u>x</u>	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>S-001, S-002</u> <u>P-014, P-019, P-006</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>14</u> MANHOURS <u>84</u>	
		NEW <u>7</u>	
		CHANGE <u>21</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:          Perform non-destructive tests and sampling on structural elements as required by operating time/cycle and conditions. Replace/verify operation of components based on operating times and cycle. Service active thermal control system, verify condition of passive thermal control systems. Verify vacuum in jacked propellant line joints. When maintenance required engine change, align engine using engine alignment GSE.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			



## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 2.13		FUNCTION TITLE: Adapter Visual Damage Inspection	
FUNCTION OBJECTIVE: Post-flight visual inspection for evidence of flight and/or handling damage.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>6</u> MIN <u>4</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>2</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES _____ NO <u>X</u>	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-003, H-007</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES <u>4</u> MANHOURS <u>24</u>	
		NEW <u>2</u>	
		CHANGE <u>6</u>	
OPERATIONS: Move Adapter on its transport dolly to inspection and cleaning area and spot in Deployment Adapter Workstand. Perform visual inspection of inner and outer skin, umbilicals, latching and "drive mechanism, interface rings pressure lines, fittings and valves. Note condition of discrepant items and tag.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED: N/A			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 2.14		FUNCTION TITLE: Clean and Prep to Move Adapter	
FUNCTION OBJECTIVE: Clean adapter to be compatible with class 100,000 cleanliness requirements and prepare for maintenance and checkout.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>6</u> MIN <u>4</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>2</u> AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES _____ NO <u>X</u>	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-007</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>4</u> MANHOURS <u>24</u>	
		NEW <u>2</u> <u>6</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS: Wipe down adapter with cleaning chemical and vacuum to meet class 100,000 cleanliness requirements. Attach adapter handling equipment.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED: Cleaning chemicals			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 2.15		FUNCTION TITLE: Move into TPF Checkout Area	
FUNCTION OBJECTIVE: Move adapter to 100,000 clean area for maintenance and checkout.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>4</u> MIN <u>2</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		HAZARDOUS YES <u>X</u> NO <u>      </u>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>2</u> TEST CONDUCTOR <u>      </u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>      </u> MECH/STRU/TH TECH <u>      </u> AVIONICS TECH <u>      </u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>      </u> TECHNICAL SUPPORT <u>      </u>		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-003</u>	
		PROCEDURES PAGES <u>5</u> <u>3</u> MANHOURS <u>30</u> <u>9</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Move dolly from airlock into TPF checkout area, install in adapter workstand, position movable platforms, remove handling GSE.			
REMARKS:  Hazardous due to hoisting operations			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 2.16		FUNCTION TITLE: Isolate Hardware Causing Anomalies	
FUNCTION OBJECTIVE: Troubleshoot and isolate components (LRU's) which have caused anomalies.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>5</u> MIN <u>3</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES _____ NO <u>X</u>	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>A-014</u> _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>5</u> <u>3</u> MANHOURS <u>30</u> <u>9</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS: Function adapter systems and troubleshoot as required to accomplish isolation of components (LRU) which have caused anomalies on the previous mission.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED: Facility power			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 2.17		FUNCTION TITLE: Scheduled Adapter Maintenance and Modification	
FUNCTION OBJECTIVE: Accomplish scheduled maintenance, inspection and servicing.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>6</u> MIN <u>4</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		HAZARDOUS YES _____ NO <u>X</u>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>7</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>2</u> MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>A-014, P-011, P-016</u> <u>P-001</u>	
		PROCEDURES NEW PAGES <u>7</u> MANHOURS <u>42</u> CHANGE <u>4</u> <u>12</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: CMB <input type="checkbox"/> OFF ON BOARD COMP <input type="checkbox"/> TUG ON BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS: Perform non-destructive tests or sampling on structural elements. Functional check adapter pressurization plumbing. Replace/verify operation of components based on operating times and cycles. Perform modifications required. Perform functional docking test utilizing Tug-S/C mass, C.G. simulators after every TBD flight and docking mechanism replacement.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED: GN <sub>2</sub> , Facility Power			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 2.18		FUNCTION TITLE: Purge LH <sub>2</sub> tank	
FUNCTION OBJECTIVE: Reduce H <sub>2</sub> gas concentration to safe level for transportation to KSC			
SITE LOCATION ETR <input type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>8</u> MIN <u>4</u>	
		HAZARDOUS YES <u>x</u> NO <u>      </u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input checked="" type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5</u> TEST CONDUCTOR <u>      </u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>2</u> MECH/STRU/TH TECH <u>      </u> AVIONICS TECH <u>1</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>      </u> TECHNICAL SUPPORT <u>      </u>	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) <u>P-016</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
		PROCEDURES PAGES <u>3</u> MANHOURS <u>18</u>	
		NEW <u>2</u> <u>6</u>	
		CHANGE	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Using Tug on-board helium supply purge LH <sub>2</sub> tanks. Monitor tank pressures. Stop purge when concentration level is four per cent H <sub>2</sub> by volume or less. Vent to 18 ± 1 psia and lock up.			
REMARKS: Hazardous because of concentrated H <sub>2</sub> gas. Vent gas external to OPF.			
COMMODITIES/CONSUMABLES REQUIRED: Facility helium required if Tug helium spheres are empty.			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 2.19		FUNCTION TITLE: Service Fuel Cells and Purge Reactant Tanks	
FUNCTION OBJECTIVE: Service fuel cell for deactivation and safe reactant tanks for transportation			
SITE LOCATION ETR <input type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>8</u> MIN <u>4</u>	
HAZARDOUS YES <u>x</u> NO <u>      </u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input checked="" type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> FCR <input type="checkbox"/> ORB <input type="checkbox"/>   		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5</u> TEST CONDUCTOR <u>      </u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>2</u> MECH/STRU/TH TECH <u>      </u> AVIONICS TECH <u>1</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>      </u> TECHNICAL SUPPORT <u>      </u>	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) <u>P-002,</u>   			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
PROCEDURES		NEW PAGES <u>8</u> MANHOURS <u>48</u>	CHANGE <u>4</u> <u>12</u>
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Connect fuel cell servicing GSE, drain H <sub>2</sub> O from system, purge fuel cells to remove moisture and lock up with a blanket pressure of 19 ± 1 psia. Purge LH <sub>2</sub> reactant tank. Monitor tank pressures. Stop purge when concentration level is four per cent H <sub>2</sub> by volume or less. Pressurize to flight pressure and lock up.			
REMARKS: Hazardous because of H <sub>2</sub> gas concentration.			
COMMODITIES/CONSUMABLES REQUIRED: Facility helium required if Tug spheres empty.			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 2.20		FUNCTION TITLE: Visual External Damage Inspection	
FUNCTION OBJECTIVE:  Post flight visual inspection of designated areas in preparation for shipment to KSC			
SITE LOCATION ETR <input type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>4</u> MIN <u>2</u>	
HAZARDOUS YES _____ NO <u>x</u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input checked="" type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>7</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>2</u> MECH/STRU/TH TECH <u>2</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) _____ _____ _____			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
PROCEDURES		NEW PAGES <u>4</u>	CHANGE <u>2</u>
		MANHOURS <u>24</u>	<u>6</u>
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Perform a visual damage inspection of exterior surfaces as follows: Deployment adapter, forward skirt, LH <sub>2</sub> main shell and intertank skirt.			
REMARKS:  N/A			
COMMODITIES/CONSUMABLES REQUIRED:  N/A			



# TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 2.21		FUNCTION TITLE: Prepare to Ship	
FUNCTION OBJECTIVE:  Prepare Tug for shipment to KSC			
SITE LOCATION ETR <input type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>10</u> MIN <u>5</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input checked="" type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH <u>3</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		HAZARDOUS YES <u>x</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-024, H-018, H-019</u> _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES _____ MANHOURS _____	
OPERATIONS:  Attach handling sling, hoist and install Tug and adapter in cargo canister. Hook up transportation instrumentation kit for Tug movement.			
REMARKS:  Hazardous because of Tug handling			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 2.22		FUNCTION TITLE: Move to OLF	
FUNCTION OBJECTIVE: Move Tug from OPF to OLF for loading and transport to KSC			
SITE LOCATION ETR <input type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>2</u> MIN <u>1</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> <u>Transportation</u>		PERSONNEL (HEADCOUNT) <u>2</u> TOTAL MANPOWER _____ TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> _____ PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		HAZARDOUS YES <u>x</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-024</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
		PROCEDURES PAGES <u>2</u> MANHOURS <u>12</u>	
		NEW <u>1</u> <u>3</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Using the prime mover tow the Tug in the cargo canister to the OLF.			
REMARKS:  Hazardous because of transportation			
COMMODITIES/CONSUMABLES REQUIRED:  N/A			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 2.23		FUNCTION TITLE: Load on aircraft and ship to ETR	
FUNCTION OBJECTIVE:  Transport Tug from WTR to ETR			
SITE LOCATION ETR <input type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>6</u> MIN <u>4</u>	
HAZARDOUS YES <u>x</u> NO <u>      </u>			
AREA LOCATION OLF <input checked="" type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>1</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-022</u> _____ _____ _____			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
PROCEDURES		NEW PAGES <u>3</u>	CHANGE <u>2</u>
MANHOURS <u>18</u>		<u>6</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  When the cargo pod transporter arrives at the OLF it will be towed into the MDF. The pod will be detached from the transporter and raised to position at the top of the MDF. The 747 will then be towed into the MDF and the cargo pod will be attached to the aircraft. The 747 with piggyback cargo pod attached will be towed out of the MDF and to the airstrip for taxi and takeoff.			
REMARKS:  Hazardous because of transportation			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 2.24.		FUNCTION TITLE: Verify Tug Status, Check Transport Data	
FUNCTION OBJECTIVE:  Check transportation environment			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>2</u> MIN <u>1</u>	
AREA LOCATION OLF <input checked="" type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>4</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH _____ AVIONICS TECH <u>1</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____ _____ _____	
		HAZARDOUS YES _____ NO <u>x</u>	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-023</u> _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
		PROCEDURES PAGES <u>2</u> NEW <u>1</u> CHANGE MANHOURS <u>12</u> <u>3</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Examine transport instrumentation data for indication of possible Tug damage			
REMARKS: N/A			
COMMODITIES/CONSUMABLES REQUIRED:  N/A			

# TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: <b>2.25</b>		FUNCTION TITLE: <b>Condition Inspection</b>	
FUNCTION OBJECTIVE: <b>Visually verify condition of Tug</b>			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>2</u> MIN <u>1</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> TEST CONDUCTOR _____ TEST ENGINEERS _____ PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>3</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES _____ NO <u>x</u>	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY)  <u>as required</u> _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>4</u> MANHOURS <u>24</u>	
		NEW <u>2</u> <u>6</u>	
		CHANGE <u>2</u> <u>6</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  <b>Remove access/inspection panels and visually inspect Tug for flight and transportation damage and general condition, i.e., hazardous conditions, cleanliness, etc.</b>			
REMARKS:  <b>N/A</b>			
COMMODITIES/CONSUMABLES REQUIRED:  <b>N/A</b>			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 2.26		FUNCTION TITLE: Internal Area Cleaning	
FUNCTION OBJECTIVE:  Clean internal areas to be compatible with cleanliness requirements.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>7</u> MIN <u>4</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>2</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____ _____ _____	
		HAZARDOUS YES _____ NO <u>x</u> _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>5</u> NEW <u>3</u> CHANGE MANHOURS <u>30</u> <u>9</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Wipe down internal areas of Tug with cleaning chemical and vacuum to meet cleanliness requirements.			
REMARKS:  Factory clean processing			
COMMODITIES/CONSUMABLES REQUIRED:  Cleaning chemical			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 2.27		FUNCTION TITLE: Internal Area Cleaning	
FUNCTION OBJECTIVE:  Clean internal area to be compatible with cleanliness requirements.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>3</u> MIN <u>2</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>2</u> AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES _____ NO <u>X</u>	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-007</u> _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>2</u> MANHOURS <u>12</u>	
		NEW <u>1</u> <u>3</u>	
		CHANGE	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Wipe down internal areas of Adapter with cleaning chemical and vacuum to meet cleanliness requirements.			
REMARKS:  Factory clean processing			
COMMODITIES/CONSUMABLES REQUIRED:  Cleaning Chemical			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: <b>3.1</b>		FUNCTION TITLE: <b>Unscheduled Tug Maintenance</b>	
FUNCTION OBJECTIVE:  Perform unscheduled maintenance required by flight and test data analysis results.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX ____ * ____ MIN <u>as required</u>	
HAZARDOUS YES _____ NO <u>x</u> _____			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> <u>12*</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>1</u> <u>3*</u> PROPULSION TECH <u>1</u> <u>2*</u> MECH/STRU/TH TECH <u>1</u> <u>2*</u> AVIONICS TECH <u>1</u> <u>2*</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> <u>3*</u> TECHNICAL SUPPORT _____ _____	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY)  <u>as required</u> _____ _____ _____			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>14</u> MANHOURS <u>84</u>	
		NEW <u>7</u> <u>21</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  From flight performance data, ground test/inspection data and component trend analysis the requirements for unscheduled maintenance and refurbishment of LRU's and in-place refurbishment of systems or structures as required.  On Tug engineering model remove access panels and LRUs to demonstrate accessibility and verify methods.			
REMARKS: * Maximum time to complete without impacting in line refurbishment approximately 16 hours.			
COMMODITIES/CONSUMABLES REQUIRED:			



## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 3.2		FUNCTION TITLE: Unscheduled Adapter Maintenance	
FUNCTION OBJECTIVE: Perform unscheduled maintenance required by flight and test data analysis results.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX * MIN <u>as required</u>	
HAZARDOUS YES _____ NO <u>X</u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5</u> <u>10*</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> <u>2*</u> PROPULSION TECH <u>3*</u> MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> <u>2*</u> TECHNICAL SUPPORT _____	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>As Required</u>			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES		NEW PAGES <u>6</u>	CHANGE <u>3</u>
		MANHOURS <u>36</u>	<u>9</u>
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS: Accomplish unscheduled component replacement, system repair and refurbishment where flight data and ground tests/inspections indicate malfunction or trends toward parameter limits.  On Tug engineering model demonstrate engine changeout.			
REMARKS: * Maximum time to complete without impacting in line refurbishment approximately 5 hours.			
COMMODITIES/CONSUMABLES REQUIRED: N/A			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.1		FUNCTION TITLE: Unload from Aircraft	
FUNCTION OBJECTIVE:  Safely unload Tug from Aircraft			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>10</u> MIN <u>4</u>	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>  _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>2</u> <u>5*</u> <u>5**</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> _____ PROPULSION TECH _____ MECH/STRU/TH TECH <u>2*</u> <u>2**</u> _____ AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> _____ QUAL CONT. TECH <u>1*</u> <u>1**</u> _____ TECHNICAL SUPPORT _____	
		HAZARDOUS YES <u>x</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) <u>H-022</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
		PROCEDURES PAGES <u>3</u> MANHCURS <u>18</u>	
		NEW <u>2</u> <u>6</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  After engine shutdown and post flight checks, the 747 will be towed into the MDF. The cargo canister will be disconnected and lifted free of the aircraft, the aircraft will be towed out of the MDF, and the cargo canister transporter will be towed into the MDF. The canister will be lowered and attached to its transporter which will then be towed to the processing facility.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.2		FUNCTION TITLE: Verify Tank Breather Assembly Operation & Check Transport Instrumentation	
FUNCTION OBJECTIVE: Verify proper breather/desiccant condition and check transportation environ- ment.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>4</u> MIN <u>1</u>	
HAZARDOUS YES _____ NO <u>X</u>			
AREA LOCATION OLF <input checked="" type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>4</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH _____ AVIONICS TECH <u>1</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____ _____	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-020, H-023</u> _____ _____ _____			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
PROCEDURES		NEW PAGES <u>2</u> MANHOURS <u>12</u>	CHANGE <u>1</u> <u>3</u>
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Inspect condition of tank breather assemblies for filter and desiccant condition. Examine transportation instrumentation data for indication of possible Tug damage.			
REMARKS: N/A			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.3		FUNCTION TITLE: Move to Tug Processing Facility	
FUNCTION OBJECTIVE: D Move Tug from OLF to TPF for receiving and inspection activities.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX 16 MIN 4	
HAZARDOUS YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> <u>Transportation</u>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER 2 8* 9** TEST CONDUCTOR _____ TEST ENGINEERS 1 PROPULSION TECH 2** MECH/STRU/TH TECH 5* 3** AVIONICS TECH _____ SAFETY ENGINEER 1 QUAL CONT. TECH 2* 2** TECHNICAL SUPPORT _____	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) H-025, H-018, H-004, H-001 H-032			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
PROCEDURES		NEW PAGES 2 MANHOURS 12	CHANGE 1 3
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS: Using the Prime Mover tow the Tug in the Tug Transtainer to the TPF airlock. Remove transportation cover and attach handling equipment. Rotate Tug to vertical and position in Tug workstand. Remove Tug access and inspection panels.			
REMARKS: Hazardous due to movement and hoisting			
COMMODITIES/CONSUMABLES REQUIRED: N/A			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.3A		FUNCTION TITLE: Move to TPF C/O Cell	
FUNCTION OBJECTIVE:  Transport Tug from OLF to TPF for receiving and inspection activities			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>6</u> MIN <u>4</u>	
HAZARDOUS YES <u>X</u> NO <u>      </u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>   		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>2</u> TEST CONDUCTOR <u>      </u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>      </u> MECH/STRU/TH TECH <u>      </u> AVIONICS TECH <u>      </u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>      </u> TECHNICAL SUPPORT <u>      </u>	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-001, H-004, H-018, H-025</u>   			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
PROCEDURES		NEW PAGES <u>2</u> MANHOURS <u>12</u>	
CHANGE <u>1</u> <u>3</u>			
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Using the Prime Mover tow the Tug to the TPF. Remove transportation cover and visually verify Tug in safe condition. Attach handling GSE and rotate Tug to vertical. Position Tug in workstand and remove Tug access and inspection panels.			
REMARKS:  Hazardous due to movement and hoisting Factory clean processing			
COMMODITIES/CONSUMABLES REQUIRED:  N/A			

FUNCTION NO: 4.4		FUNCTION TITLE: Receiving Inspection	
FUNCTION OBJECTIVE:  Visually verify condition of Tug.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>16</u> MIN <u>2</u>	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		HAZARDOUS YES _____ NO <u>X</u>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> 8* 8** TEST CONDUCTOR _____ TEST ENGINEERS <u>2</u> 2* 2** PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>3</u> TECHNICAL SUPPORT _____		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>As required.</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES		NEW PAGES <u>6</u> MANHOURS <u>36</u>	CHANGE <u>3</u> <u>9</u>
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Visual inspection of Tug and subsystems for damage, missing hardware, workmanship, and general condition.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.5		FUNCTION TITLE: Install Ship-Loose Equipment	
FUNCTION OBJECTIVE:  Prepare Tug for subsystems testing.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>20</u> MIN <u>8</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>7</u> 9** TEST CONDUCTOR _____ TEST ENGINEERS <u>2</u> PROPULSION TECH <u>1</u> 2** MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>2</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> 2** TECHNICAL SUPPORT _____	
		HAZARDOUS YES _____ NO <u>X</u>	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>As Required</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES <u>7</u> MANHOURS <u>42</u>	
		NEW <u>4</u> CHANGE <u>12</u>	
OPERATIONS:  Install and electrically connect Tug ship loose components and configure for subsystems tests.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.6		FUNCTION TITLE: Leak Check Tug Pressurization System	
FUNCTION OBJECTIVE: Verify Integrity of Pressure System			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>10</u> MIN <u>3</u>	
HAZARDOUS YES, <u>X</u> NO <u>          </u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>   		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5 8* 8**</u> TEST CONDUCTOR <u>1* 1**</u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>2 4* 4**</u> MECH/STRU/TH TECH <u>          </u> AVIONICS TECH <u>          </u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT <u>          </u>	
GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) <u>P-002, P-009, P-011, P-016</u>   			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES PAGES <u>3</u> MANHOURS <u>18</u>		NEW <u>2</u> CHANGE <u>6</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Connect GSE and facility helium supply, clear area of personnel, pressurize pressurization system to 3100 $\pm$ 100 psig and stabilize for 30 minutes. Open access to essential personnel, leak check (decay) for 30 minutes. Soap/bubble check all mechanical joints. Verify proper tank pressure regulation to LH <sub>2</sub> , LO <sub>2</sub> , APS and fuel cell reactant tanks. Retain pressure in system for use during remaining leak checks. Tag system indicating condition. Verify insulation purge integrity.			
REMARKS:  Periodic checks of tank pressures will be monitored by LPS. Hazardous because of pressure.			
COMMODITIES/CONSUMABLES REQUIRED:  Facility Helium			



# TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.7		FUNCTION TITLE: Leak Check LO <sub>2</sub> Tank	
FUNCTION OBJECTIVE: Verify LO <sub>2</sub> System Integrity			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>16</u> MIN <u>3</u>	
HAZARDOUS YES <u>X</u> NO <u>      </u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5</u> 7* 7** TEST CONDUCTOR <u>      </u> 1* 1** TEST ENGINEERS <u>1</u> PROPULSION TECH <u>2</u> 3* 3** MECH/STRU/TH TECH <u>      </u> AVIONICS TECH <u>      </u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT <u>      </u> _____ _____	
GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>P-016</u> _____ _____ _____			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES		NEW PAGES <u>7</u> MANHOURS <u>42</u>	CHANGE <u>4</u> <u>12</u>
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Connect GSE and facility Helium spply. Clear area of personnel, pressurize tank to 31 ± 1 psia, stabilize tank pressure for 30 minutes. Open access to essential personnel only. Leak check (decay) tank for 30 minutes, maximum allowable leakage - TBD psi in 30 minutes. Soap/bubble check propellant/pressure system mechanical joints. Vent system to 19 ± 1 psia and lock up. Tag system indicating condition.			
REMARKS: Remaining on-board Helium used as gas pressure source. Periodic checks of tank pressures will be monitored by LPS. Hazardous because of pressure.			
COMMODITIES/CONSUMABLES REQUIRED: Facility Helium required if Tug Helium spheres are empty.			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.8		FUNCTION TITLE: Leak Check LH <sub>2</sub> Tank	
FUNCTION OBJECTIVE: Verify LH <sub>2</sub> System integrity.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX 20 MIN 4	
HAZARDOUS YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER 5 7* 7** TEST CONDUCTOR 1 TEST ENGINEERS 1* 1** PROPULSION TECH 2 3* 3** MECH/STRU/TH TECH AVIONICS TECH SAFETY ENGINEER 1 QUAL CONT. TECH 1 TECHNICAL SUPPORT	
GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) P-016			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES		NEW PAGES 7 MANHOURS 42	CHANGE 4 12
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS: Connect GSE and facility Helium supply. Clear area of personnel, pressurize tank to 32 $\pm$ 1 psia, stabilize tank pressures for 40 minutes. Open access to essential personnel only. Leak check (decay) tank for 30 minutes, maximum allowable leakage - TBD psi in 30 minutes. Soap/bubble check propellant/pressure system mechanical joints. Vent system to 19 $\pm$ 1 psia and lock up. Tag system indicating condition.			
REMARKS: Remaining on-board Helium used as gas pressure source. Periodic checks of tank pressure will be monitored by LPS. Hazardous because of pressure.			
COMMODITIES/CONSUMABLES REQUIRED: Facility Helium required if Tug Helium spheres are empty.			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.9		FUNCTION TITLE: Leak Check Fuel Cell Reactant Tanks	
FUNCTION OBJECTIVE: Verify Reactant System integrity.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>10</u> MIN <u>2</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		HAZARDOUS YES <u>X</u> NO <u>          </u>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> 8* 8** TEST CONDUCTOR <u>1</u> * 1** TEST ENGINEERS <u>1</u> PROPULSION TECH <u>2</u> 3* 3** MECH/STRU/TH TECH <u>          </u> AVIONICS TECH <u>1</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT <u>          </u>		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>P-002</u>	
		PROCEDURES PAGES <u>8</u> NEW MANHOURS <u>48</u> CHANGE <u>4</u> <u>12</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS: Connect GSE and facility Helium supply. Clear area of personnel, pressurize reactant tanks to operating pressure. Stabilize pressure for 30 minutes, open access for essential personnel. Leak check (decay) system for 30 minutes, maximum leakage 3 psi in 30 minutes. Soap/bubble check system mechanical joints. Vent system to 19 $\pm$ 1 psia and lock up Tug system indicating condition.			
REMARKS: Periodic checks of system pressure will be monitored by LPS. Hazardous because of pressure.			
COMMODITIES/CONSUMABLES REQUIRED: Facility Helium			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.10	FUNCTION TITLE: Vent Remaining Pressurant										
FUNCTION OBJECTIVE:  Safe Pressurization System											
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>	TIME TO COMPLETE (HRS) MAX <u>6</u> MIN <u>1</u>	HAZARDOUS YES <u>x</u> NO <u>        </u>									
AREA LOCATION  ULF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>   	PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5</u> 7** TEST CONDUCTOR <u>1</u> ** TEST ENGINEERS <u>1</u> PROPULSION TECH <u>2</u> 3** MECH/STRU/TH TECH <u>        </u> AVIONICS TECH <u>        </u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT <u>        </u>	GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY)  P-016   									
	<table style="width: 100%; border: none;"> <tr> <td style="width: 40%;">PROCEDURES</td> <td style="width: 20%;">NEW</td> <td style="width: 20%;">CHANGE</td> </tr> <tr> <td>PAGES</td> <td><u>5</u></td> <td><u>3</u></td> </tr> <tr> <td>MANHOURS</td> <td><u>30</u></td> <td><u>9</u></td> </tr> </table>			PROCEDURES	NEW	CHANGE	PAGES	<u>5</u>	<u>3</u>	MANHOURS	<u>30</u>
PROCEDURES	NEW	CHANGE									
PAGES	<u>5</u>	<u>3</u>									
MANHOURS	<u>30</u>	<u>9</u>									
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>									
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>											
OPERATIONS:  Connect pressure servicing GSE, vent pressure system to maximum of 950 psia and secure Tag system indicating condition. Disconnect pressurization and leak check GSE.											
REMARKS: Hazardous due to pressure. Pressurization system pressure periodically monitored by LPS. Minimum Helium sphere pressure at lockup - 50 psia.											
COMMODITIES/CONSUMABLES REQUIRED:											

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.11		FUNCTION TITLE: Clean Tug & Prep to Move	
FUNCTION OBJECTIVE: Clean Tug to be compatible with class 100,000 cleanliness requirements and prep for maintenance and checkout.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>20</u> MIN <u>7</u>	
HAZARDOUS YES _____ NO <u>X</u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> <u>11</u> ** TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> <u>2</u> ** PROPULSION TECH <u>1</u> <u>4</u> ** MECH/STRU/TH TECH <u>2</u> <u>2</u> ** AVIONICS TECH <u>1</u> _____ SAFETY ENGINEER _____ DUAL CONT. TECH <u>1</u> <u>2</u> ** TECHNICAL SUPPORT _____ _____	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-004, H-018</u> _____ _____ _____		PROCEDURES NEW PAGES <u>9</u> CHANGE <u>5</u> MANHOURS <u>54</u> <u>15</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS: Wipe down Tug with cleaning chemical and vacuum to meet cleanliness requirements. Attach handling equipment for hoisting and disconnect GSE. Prepare workstand for Tug move.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED: Cleaning Chemical			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.12		FUNCTION TITLE: Move Into TPF Checkout Area or Storage	
FUNCTION OBJECTIVE: Move Tug into checkout area for maintenance and checkout			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>10</u> MIN <u>3</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		HAZARDOUS YES <u>X</u> NO <u>      </u>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>4 10* 10**</u> TEST CONDUCTOR <u>      </u> TEST ENGINEERS <u>1 2* 2**</u> PROPULSION TECH <u>      </u> MECH/STRU/TH TECH <u>2 5* 5**</u> AVIONICS TECH <u>      </u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>2* 2**</u> TECHNICAL SUPPORT <u>      </u>		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-001, H-026, H-031 (Alternate)</u>	
		PROCEDURES PAGES <u>4</u> MANHOURS <u>24</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Move Tug from airlock into TPF checkout area, install in Tug Workstands, position movable platforms, remove handling GSE. Alternate - to save transfer from airlock crane to checkout area crane a GSE manipulator (H-031) could be utilized to transport Tug vertically from one area or stand to another.			
REMARKS: Hazardous due to hoisting and movement. Move to storage if no mission requirement to continue in checkout.			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.13		FUNCTION TITLE: Mission Configure	
FUNCTION OBJECTIVE:  Incorporate mission peculiar modifications as required			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>6</u> MIN <u>2</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____ _____	
		HAZARDOUS YES _____ NO <u>x</u>	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>as required</u> _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>6</u> NEW MANHOURS <u>36</u> CHANGE <u>3</u> <u>9</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Add or remove specific components as required by unique mission requirements. Configure MSS/PSS console for assigned mission.			
REMARKS:  Tug modifications will include modification incorporation instructions and retest procedures.			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.14		FUNCTION TITLE: Replaced Adapter Component and Modification Verification	
FUNCTION OBJECTIVE: Verify system performance after replaced component/modification activity.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>2</u> MIN <u>1</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		HAZARDOUS YES _____ NO <u>X</u>	
		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-003, A-001, A-012</u>	
		<u>Electronic Equipment</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>5</u> MANHOURS <u>30</u>	
		NEW <u>3</u>	
		CHANGE <u>9</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS: Connect applicable GSE, verify interfaces and operation of LRU's replaced or systems modified.			
REMARKS: Required only when LRU's have been replaced or modifications have been performed.			
COMMODITIES/CONSUMABLES REQUIRED: Facility Power			



## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.15		FUNCTION TITLE: Prep For Mate With Tug	
FUNCTION OBJECTIVE: Prepare adapter for Tug mate			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>3</u> MIN <u>2</u>	
HAZARDOUS YES <u>X</u> NO <u>      </u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>4</u> TEST CONDUCTOR <u>      </u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>      </u> MECH/STRU/TH TECH <u>2</u> AVIONICS TECH <u>      </u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>      </u> TECHNICAL SUPPORT <u>      </u>	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-018, H-003</u>			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES PAGES <u>4</u> MANHOURS <u>24</u>		NEW <u>2</u> CHANGE <u>6</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS: Disconnect checkout GSE, attach handling GSE. Move to Tug for mate or to pallet for storage.			
REMARKS: Hazardous due to movement and hoisting			
COMMODITIES/CONSUMABLES REQUIRED. N/A			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.16		FUNCTION TITLE: Mate Tug with Adapter & Verify Mechanical Interface	
FUNCTION OBJECTIVE: Mate Tug with adapter and verify mechanical and electrical interface.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>32</u> MIN <u>4</u>	
HAZARDOUS YES <u>x</u> NO <u>      </u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>8</u> <u>9*</u> <u>13**</u> TEST CONDUCTOR <u>      </u> <u>1*</u> <u>1**</u> TEST ENGINEERS <u>      </u> <u>1</u> <u>2*</u> <u>2**</u> PROPULSION TECH <u>      </u> <u>1</u> <u>2**</u> MECH/STRU/TH TECH <u>      </u> <u>3</u> AVIONICS TECH <u>      </u> <u>1</u> <u>2**</u> SAFETY ENGINEER <u>      </u> <u>1</u> QUAL CONT. TECH <u>      </u> <u>1</u> <u>2**</u> TECHNICAL SUPPORT Writer <u>      </u> <u>1**</u>	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>P-011, P-016, P-001, A-017, A-001</u> <u>Electronic Equipment</u>			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES PAGES <u>5</u> MANHOURS <u>30</u>		NEW <u>3</u> CHANGE <u>9</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS: Position adapter for mating with Tug, move Tug Workstand platforms to accommodate adapter, mate and verify all docking latches latched, verify dynamic envelope (clearance) about engine. Mate pressurization interfaces and leak check. Mate electrical system interfaces and verify continuity. Mate propellant systems interfaces and leak check.			
REMARKS: Hazardous due to hoisting operations.			
COMMODITIES/CONSUMABLES REQUIRED: Facility Power, Helium			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.17		FUNCTION TITLE: Electrical Pre-Power Checks	
FUNCTION OBJECTIVE:  Verify Tug ready for power-up and systems testing			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>8</u> MIN <u>1.5</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5 8* 8**</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>1 2* 1**</u> PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH <u>2 4* 4**</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1 2* 2**</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES _____ NO <u>x</u>	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>A-001, A-002, A-003</u> <u>Electronic Equipment</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES <u>3</u> MANHOURS <u>18</u>	
		NEW <u>1</u> CHANGE <u>3</u>	
OPERATIONS:  Verify single point ground, connect GSE and verify bus isolation			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED: Facility power			

FUNCTION NO: 4.18		FUNCTION TITLE: Mechanical Alignment Verification	
FUNCTION OBJECTIVE:  Verify mechanical alignment of engine to Tug, deployment adapter to Tug, S/C adapter to Tug and guidance component platform to Tug			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>20</u> MIN <u>4</u>	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>   		HAZARDOUS YES _____ NO <u>x</u>  PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> <u>7**</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> <u>2**</u> TECHNICAL SUPPORT _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>P-006, P-008</u>          PROCEDURES PAGES <u>8</u> MANHOURS <u>48</u>	
OPERATIONS:  Where engine change has not been done verify engine alignment has not shifted using scribed alignment markings. Verify alignment of the deployment adapter and spacecraft adapter to Tug using appropriate mechanical markings. Verify the alignment of the GVN component platform with the Tug axis mechanically.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.19		FUNCTION TITLE: Apply Power to Tug	
FUNCTION OBJECTIVE:  Energize Tug subsystems for downstream testing and verify power quality.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>20</u> MIN <u>6</u>	
HAZARDOUS YES _____ NO <u>x</u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> 8* 12** TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>1</u> 2* 3** PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH <u>3</u> 4* 5** SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> 3** TECHNICAL SUPPORT _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input checked="" type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) <u>A-001, A-003, A-008</u> _____ _____ _____	
PROCEDURES		NEW PAGES <u>4</u> MANHOURS <u>24</u>	CHANGE <u>2</u> <u>6</u>
OPERATIONS:  With ground power applied to the Tug, utilize the LPS to switch on/off each subsystem. LPS to monitor power bus for noise and ripple and compare with a pre-established criteria. Verify Tug/spacecraft interface distributions.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:  Facility power			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.20		FUNCTION TITLE: Load PCM Data Format	
FUNCTION OBJECTIVE:  Load Tug onboard computer with mission peculiar data format			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>4</u> MIN <u>1</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		HAZARDOUS YES _____ NO <u>x</u>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>4</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH <u>2</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>A-009</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input checked="" type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> Data format transfer		PROCEDURES PAGES <u>5</u> <u>3</u> MANHOURS <u>30</u> <u>9</u>	
OPERATIONS:  Mission peculiar data format to be loaded into LPS and transfer to onboard computer. Verify compatibility between Tug computer and ground control.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:  Facility power			

# TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.21		FUNCTION TITLE: Measurement System End-to-End Calibration	
FUNCTION OBJECTIVE:  Calibrate Measurement System			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX 8 MIN 2	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		HAZARDOUS YES _____ NO <input checked="" type="checkbox"/>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER 7 8** TEST CONDUCTOR 1 TEST ENGINEERS 1 PROPULSION TECH 1 MECH/STRU/TH TECH 1 AVIONICS TECH 2 SAFETY ENGINEER QUAL CONT. TECH 1 2** TECHNICAL SUPPORT		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) A-010, A-013, A-008	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES		NEW PAGES 25 MANHOURS 150	CHANGE 13 40
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> 3 point step calibration			
OPERATIONS:  Utilize the LPS/Tug computers to stimulate end instruments for a calibration at a minimum of three voltage levels.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:  Facility power			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: <b>4.22</b>		FUNCTION TITLE: <b>Replaced Component and Modification Verification</b>	
FUNCTION OBJECTIVE:  <b>Verify system performance after replaced component/modification activity</b>			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>48</u> MIN <u>3</u>	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>  _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>8</u> <u>12*</u> <u>20**</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>2</u> <u>3**</u> PROPULSION TECH <u>1</u> <u>3*</u> <u>5**</u> MECH/STRU/TH TECH <u>1</u> <u>2**</u> AVIONICS TECH <u>2</u> <u>3*</u> <u>6**</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> <u>2*</u> <u>3**</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES _____ NO <u>x</u>	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY)  <u>as required by systems</u>  <u>disturbed</u>  _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>8</u> MANHOURS <u>48</u>	
		NEW <u>4</u>	
		CHANGE <u>12</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  <b>Connect applicable GSE, verify interfaces and operation of LRUs replaced or systems modified, i.e.,</b>  Purge System Leak Check Purge Bay Leak Check Propellant System Leak Check Pressurization System Leak Check APS Leak and Functional Check Hydraulic System Checkout T.C.S. Checkout Communications System Checkout AESPA Checkout  T.V. System Checkout Rendezvous and Docking System Checkout G&N System Checkout Flight Control System Checkout Power and Distr. Systems Checkout Measurement System Checkout			
REMARKS:  <b>Required only when LRUs have been replaced or modifications have been performed. Modification instructions will include retest procedures.</b>			
COMMODITIES/CONSUMABLES REQUIRED:  <b>Facility Power, Helium</b>			



## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.23		FUNCTION TITLE: Post-Maintenance MLI Purge	
FUNCTION OBJECTIVE:  Dry MLI & Purge Bag			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>8</u> MIN <u>3</u>	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>   		HAZARDOUS YES _____ NO <u>x</u>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>4</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>2</u> MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY)  P-009, P-020   	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input checked="" type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES <u>2</u> MANHOURS <u>12</u>	
		NEW <u>2</u> <u>12</u>	
		CHANGE <u>1</u> <u>3</u>	
OPERATIONS:   Hook up GSE, initiate warm N <sub>2</sub> purge for 2.5 hours to dry MLI. Terminate hot purge and connect slow H <sub>e</sub> purge to maintain insulation dry. Verify sufficient helium in adapter helium sphere to support purge.			
REMARKS:  To be accomplished if purge bag opened up during maintenance cycle. N <sub>2</sub> inlet temperature nominal 580°R (120°F)			
COMMODITIES/CONSUMABLES REQUIRED:  Facility N <sub>2</sub> and H <sub>e</sub>			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.24		FUNCTION TITLE: Dry Tug Propellant Tanks	
FUNCTION OBJECTIVE:  Dry new Tug propellant tanks to be compatible with cryogenics			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>6</u> MIN <u>3</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>4</u> <u>7**</u> TEST CONDUCT. JR _____ TEST ENGINEERS <u>1</u> <u>2**</u> PROPULSION TECH <u>2</u> <u>4**</u> MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____ _____ _____	
		HAZARDOUS YES _____ NO <u>x</u>	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY)  P-016 _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>4</u> MANHOURS <u>24</u>	
		NEW CHANGE 2 6	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Connect GSE and purge LH <sub>2</sub> and LO <sub>2</sub> tanks until moisture content compatible with cryogenics. Pressurize each tank to 19 ± 1 psia and lock up. Tag system indicating condition.			
REMARKS: Accomplish on each new Tug or if propellant tank entered during recycle operations. Periodic check of tank pressure will be monitored by LPS.			
COMMODITIES/CONSUMABLES REQUIRED:  CH <sub>4</sub>			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: <b>4.25</b>		FUNCTION TITLE: <b>Mate Tug with Kick Stage</b>	
FUNCTION OBJECTIVE: <b>Mate Tug with Kick Stage Mechanically and Electrically</b>			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>8</u> MIN <u>2</u>	
HAZARDOUS YES <u>x</u> NO <u>      </u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> <u>9*</u> <u>9**</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> <u>2*</u> <u>2**</u> PROPULSION TECH _____ MECH/STRU/TH TECH <u>2</u> AVIONICS TECH <u>1</u> <u>2*</u> <u>2**</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> <u>2*</u> <u>2**</u> TECHNICAL SUPPORT _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>A-001, A-016</u> _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input checked="" type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>5</u> <u>3</u> MANHOURS <u>30</u> <u>9</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  <b>Connect LPS to energize pin pullers to the retracted position and verify mate interface. Lift kick stage into mate position and align attach points. Extend pin pullers to latch position and verify mechanical alignment.</b>			
REMARKS:  <b>Hazardous due to hoisting operations</b>			
COMMODITIES/CONSUMABLES REQUIRED:          			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.26		FUNCTION TITLE: Verify Interfaces and Prepare for SHE	
FUNCTION OBJECTIVE: Verify signal continuity across Tug/kick stage interface and kick stage power activation.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>28</u> MIN <u>8</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>7</u> <u>8*</u> <u>9**</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>1</u> <u>2**</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>1</u> <u>3*</u> <u>3**</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> <u>2*</u> <u>2**</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES <u>x</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>A-001, A-016, A-008</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>5</u> <u>3</u> MANHOURS <u>30</u> <u>9</u>	
SOFTWARE REQUIREMENTS: LPS <input checked="" type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS: Verify correct pin-to-pin continuity and power distribution. Utilize the LPS to command signals across Tug/kick stage interface and verify response.			
REMARKS: Hazardous due to ordnance. Special cabling will be required for ordnance circuit.			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: <b>4.27</b>		FUNCTION TITLE: <b>Load and Verify Computer Software</b>	
FUNCTION OBJECTIVE:  <b>Load Tug computer with Test Software</b>			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>2</u> MIN <u>0.1</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>2</u> 3** TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH <u>1</u> 2** SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		HAZARDOUS YES _____ NO <u>x</u>	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) <b>A-009, A-008</b> _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input checked="" type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>5</u> MANHOURS <u>30</u>	
		NEW <u>3</u> <u>9</u>	
		CHANGE	
SOFTWARE REQUIREMENTS: LPS <input checked="" type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input checked="" type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  <b>Utilize the LPS to load the Tug computer with mission peculiar test software.</b>			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.28		FUNCTION TITLE: Systems Health Evaluation (SHE)	
FUNCTION OBJECTIVE: Verify Tug subsystem performance is in accordance with established go/no-go criteria			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>32</u> MIN <u>8</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>12</u> <u>13**</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>2</u> PROPULSION TECH <u>2</u> MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>3</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>2</u> TECHNICAL SUPPORT <u>1**</u> Tech Writer	
		HAZARDOUS YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) A-001, A-016	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>25</u> MANHOURS <u>150</u>	
		NEW <u>15</u> <u>45</u>	
		CHANGE	
SOFTWARE REQUIREMENTS: LPS <input checked="" type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  With the Tug or Tug/kick stage in a simulated flight posture, ordnance function monitored via special cabling, command the Tug/kick stage through the normal mode of operation. All commandable backup/redundancy modes will be exercised. All time critical sequences will be verified. Selected data points will be monitored to compare with pre-established trend data.			
REMARKS: Hazardous only when ordnance is installed.			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.29		FUNCTION TITLE: Install Ordnance	
FUNCTION OBJECTIVE:  Install Flight Ordnance			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>8</u> MIN <u>2</u>	
HAZARDOUS YES <u>x</u> NO _____			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>8</u> 9** TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>3</u> MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> 2** TECHNICAL SUPPORT _____	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>Electronic equipment</u> _____ _____			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES PAGES <u>2</u> MANHOURS <u>12</u>		NEW <u>1</u> CHANGE <u>3</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Mechanically install Tug ordnance. Verify shielding caps in place. For kick stage, install safe and arm device and verify safety pin in place.  Ordnance simulators will be used for Tug engineering model checkout.			
REMARKS:          			
COMMODITIES/CONSUMABLES REQUIRED:          			

# TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.30		FUNCTION TITLE: Unload Kick Stage & Ship Loose Hardware	
FUNCTION OBJECTIVE:  Safety unload kick stage from Transport Aircraft			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>7</u> MIN <u>3</u>	
		HAZARDOUS YES <u>X</u> NO <u>      </u>	
AREA LOCATION OLF <input checked="" type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>   		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>2</u> TEST CONDUCTOR <u>      </u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>      </u> MECH/STRU/TH TECH <u>      </u> AVIONICS TECH <u>      </u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>      </u> TECHNICAL SUPPORT <u>      </u>	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) <u>H-028, H-010</u>   	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>2</u> MANHOURS <u>12</u>	
		NEW <u>1</u> <u>3</u>	
		CHANGE	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Release aircraft to kick stage Transtainer tie downs, extend wheels, attach prime mover, and remove stage from aircraft via ramps.			
REMARKS:  Hazardous due to movement.			
COMMODITIES/CONSUMABLES REQUIRED:			



## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.31		FUNCTION TITLE: Move to Tug Processing Facility Airlock	
FUNCTION OBJECTIVE: Move kick stage to TPF airlock for receiving inspection.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>4</u> MIN <u>2</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> <u>Transportation</u>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>2</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		HAZARDOUS YES <u>X</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>GFE Equipment, H-028, H-026</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>2</u> MANHOURS <u>12</u>	
		NEW <u>2</u> CHANGE <u>1</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS: Using the Prime Mover, tow the kick stage in its Transtainer to the TPF airlock. Remove transport cover, and position portable workstands as required. Remove prime mover.			
REMARKS: Hazardous because of transportation.			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.31A		FUNCTION TITLE: Move to Tug Processing Facility	
FUNCTION OBJECTIVE: Move kick stage to TPF for receiving inspection.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>4</u> MIN <u>2</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> <u>Transportation</u>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>2</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		HAZARDOUS YES <u>X</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) GFE Equipment, H-028, H-026	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input checked="" type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>2</u> MANHOURS <u>12</u>	
		NEW <u>1</u> <u>3</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS: Using the Prime Mover, tow the kick stage in its Transtainer to the TPF. Remove transport cover, and position portable workstands as required. Remove prime mover.			
REMARKS:  Hazardous because of transportation. Factory clean processing.			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.32		FUNCTION TITLE: Receiving Inspection	
FUNCTION OBJECTIVE:  Visually verify condition of Kick Stage			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>8</u> MIN <u>4</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		HAZARDOUS YES _____ NO <u>X</u>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5</u> TEST CONDUCTOR _____ TEST ENGINEERS _____ PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>2</u> TECHNICAL SUPPORT _____		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-026</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES <u>4</u> MANHOURS <u>24</u>	
		NEW <u>2</u> CHANGE <u>6</u>	
OPERATIONS:  Visual inspection of Kick Stage and subsystem for damage, missing hardware, workmanship, and general condition.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.33		FUNCTION TITLE: Clean Kick Stage	
FUNCTION OBJECTIVE:  Clean Kick Stage to be compatible with class 100,000 cleanliness requirements.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>9</u> MIN <u>5</u>	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>   		HAZARDOUS YES _____ NO <u>X</u>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>2</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER _____ QUAL C. INT. TECH <u>1</u> TECHNICAL SUPPORT _____		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-018, H-026</u>   	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES <u>3</u> MANHOURS <u>18</u>	
NEW		CHANGE	
OPERATIONS:  Wipe down Kick Stage with cleaning chemical and vacuum to meet cleanliness requirements. Attach handling equipment.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

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## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.34		FUNCTION TITLE: Unload Kick Stage Motor, Move to TPF Airlock	
FUNCTION OBJECTIVE: Safely unload motor and move to airlock.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>10</u> MIN <u>4</u>	
HAZARDOUS YES <u>X</u> NO <u>      </u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> <u>Transportation</u>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>4</u> TEST CONDUCTOR <u>      </u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>      </u> MECH/STRU/TH TECH <u>2</u> AVIONICS TECH <u>      </u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>      </u> TECHNICAL SUPPORT <u>      </u>	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-011, H-026, H-030</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>4</u> MANHOURS <u>24</u>	
		NEW <u>2</u> <u>6</u>	
		CHANGE	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Unload motor from aircraft or rail and attach prime mover for ground motor transportation, deliver motor to TPF dock. Move motor into TPF airlock, remove transportation cover and position portable work stands as required.			
REMARKS:  Hazardous because of transportation.			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.35		FUNCTION TITLE: Receiving Inspection	
FUNCTION OBJECTIVE:  Visually verify condition of Kick Stage Motor.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>2</u> MIN <u>1</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>4</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH <u>2</u> TECHNICAL SUPPORT _____ _____ _____	
		HAZARDOUS YES _____ NO <u>X</u>	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-026, H-023</u> _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES NEW PAGES <u>3</u> MANHOURS <u>18</u>	
		CHANGE <u>2</u> <u>6</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Visual inspection of motor for damage, missing hardware, and general condition. Inspect shipping recorder data for indication of possible damage.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.36		FUNCTION TITLE: Clean Kick Stage Motor	
FUNCTION OBJECTIVE: Clean motor to be compatible with class 100,000 cleanliness requirements.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>7</u> MIN <u>3</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>2</u> MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES _____ NO <u>X</u>	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-018, H-026</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>2</u> MANHOURS <u>12</u>	
		NEW <u>2</u>	
		CHANGE <u>1</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS: Wipe down with cleaning chemical and vacuum to meet class 100,000 cleanliness requirements. Attach handling equipment for hoisting.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.37		FUNCTION TITLE: Move into Checkout Area	
FUNCTION OBJECTIVE:  Move Kick Stage into clean C/O area and install in fixture.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>5</u> MIN <u>2</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>2</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		HAZARDOUS YES <u>X</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-018, H-012</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>2</u> MANHOURS <u>12</u>	
		NEW <u>2</u> CHANGE <u>1</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Hoist Kick Stage from transtainer and move into checkout area and install on buildup and checkout fixture.			
REMARKS:  Hazardous due to movement.			
COMMODITIES/CONSUMABLES REQUIRED:			



## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.38		FUNCTION TITLE: Install Ship Loose Components	
FUNCTION OBJECTIVE:  Build up stage.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>16</u> MIN <u>8</u>	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>   		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>8</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>2</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>3</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		HAZARDOUS YES _____ NO <u>X</u>	
PROCEDURES		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>As required.</u>	
PAGES <u>6</u>		NEW	
MANHOURS <u>36</u>		CHANGE <u>3</u>	
OPERATIONS:  Install and connect the kick stage ship loose components into a complete stage less motor.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.39		FUNCTION TITLE: Power & Distribution System Checkout	
FUNCTION OBJECTIVE:  Verify proper power and power distribution			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>12</u> MIN <u>6</u>	
HAZARDOUS YES _____ NO <u>X</u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH _____ AVIONICS TECH <u>2</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____	
GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) <u>A-001, A-002, A-003</u> _____ _____ _____			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES		NEW PAGES <u>5</u>	CHANGE <u>3</u>
		MANHOURS <u>30</u>	<u>9</u>
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Connect checkout GSE, apply ground power to buses. Verify power distribution and regulation system. Functional system and verify operation.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:  Facility Power			

FUNCTION NO: 4.40		FUNCTION TITLE: Measurement System End to End Calibration	
FUNCTION OBJECTIVE:  Calibrate measurement system.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>4</u> MIN <u>2</u>	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>   		HAZARDOUS YES _____ NO <u>X</u>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH <u>3</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>A-013, A-008</u>   	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES		NEW PAGES <u>10</u> MANHOURS <u>60</u>	CHANGE <u>5</u> <u>15</u>
SOFTWARE REQUIREMENTS: LPS <input checked="" type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> kick stage			
OPERATIONS:  Utilize the LPS/Kick Stage computers to stimulate end instruments for a calibration at a minimum of three voltage levels.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:  Facility, Power			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.41		FUNCTION TITLE: APS Pressure/Leak Checks	
FUNCTION OBJECTIVE:  Verify pressure and functional integrity of Kick Stage APS.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>8</u> MIN <u>4</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		HAZARDOUS YES <u>X</u> NO _____	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>4</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>2</u> MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> QUAL CONT. TECH _____ TECHNICAL SUPPORT _____		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>P-011</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES		NEW PAGES <u>6</u> MANHOURS <u>36</u>	CHANGE <u>3</u> <u>9</u>
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Connect pressure and leak check GSE, clear area of personnel. Pressurize APS storage spheres to flight pressure and stabilize for 30 minutes. Pressurize third side and equalize pressure across diaphragm. Leak check (decay) fluid side. Soap/bubble check all connections. Verify proper pressure regulation of pressurization system. Leak check pressure side. Vent pressures.			
REMARKS:  Hazardous because of pressures.			
COMMODITIES/CONSUMABLES REQUIRED:  Helium, Facility Power			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.42		FUNCTION TITLE: APS Functional Checks	
FUNCTION OBJECTIVE:  Verify proper APS valve response			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX 10 MIN 4	
HAZARDOUS YES _____ NO <input checked="" type="checkbox"/>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER 4 TEST CONDUCTOR _____ TEST ENGINEERS 1 PROPULSION TECH 2 MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH 1 TECHNICAL SUPPORT _____	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY)  P-011, A-008	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES 4 MANHOURS 24	
		NEW 2 6	
SOFTWARE REQUIREMENTS: LPS <input checked="" type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  In conjunction with control system checkout, perform an APS functional check to verify proper valve responses to input stimuli.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.43		FUNCTION TITLE: Control System Checkout	
FUNCTION OBJECTIVE:  Verify the control system ability to determine spatial position and provide proper response.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>16</u> MIN <u>8</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>   		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>          </u> MECH/STRU/TH TECH <u>          </u> AVIONICS TECH <u>3</u> SAFETY ENGINEER <u>          </u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT <u>          </u>	
		HAZARDOUS YES <u>          </u> NO <u>X</u>	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>A-007, A-008, A-009, A-013, A-001</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>5</u> MANHOURS <u>30</u>	
		NEW <u>3</u> CHANGE <u>9</u>	
SOFTWARE REQUIREMENTS: LPS <input checked="" type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Connect GSE and apply power to system. Verify autopilot performance and system response. Verify operation of the flight computer, IMU, star tracker, sun sensor, etc., as required by mission assignment.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED: Facility Power			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.44		FUNCTION TITLE: R.F. System Checkout	
FUNCTION OBJECTIVE: Verify functional operation of communications and Data Management Systems.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>24</u> MIN <u>12</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>7</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>2</u> PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH <u>3</u> SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT <u>1</u>	
		HAZARDOUS YES _____ NO <u>X</u>	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>A-001, A-006, A-008</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>18</u> MANHOURS <u>108</u>	
		NEW <u>9</u> <u>27</u>	
SOFTWARE REQUIREMENTS: LPS <input checked="" type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Connect GSE and apply power, verify uplink command receipt and downlink response. Verify data storage capability, data conditioning, multiplexing, and timing. Operate and verify central logic/computer. Stimulate and verify Caution and Warning System.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED: Facility Power			

# TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.45		FUNCTION TITLE: Install Motor in Stage	
FUNCTION OBJECTIVE:  Complete Kick Stage Buildup			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>6</u> MIN <u>4</u>	
HAZARDOUS YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>2</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY)  As required.			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES		NEW PAGES <u>3</u> MANHOURS <u>18</u>	CHANGE <u>2</u> <u>6</u>
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Move into TPF clean area and install in Kick Stage. Attach and connect to kick stage system.			
REMARKS:  Hazardous because of hoisting.			
COMMODITIES/CONSUMABLES REQUIRED:			



## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.46		FUNCTION TITLE: CST Preps	
FUNCTION OBJECTIVE: Configure all systems for Kick Stage combined Systems Test			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>3</u> MIN <u>1</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>7</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>3</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES _____ NO <u>X</u>	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>A-001, A-008</u> _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>12</u> MANHOURS <u>72</u>	
		NEW <u>6</u> CHANGE <u>18</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Connect GSE and simulators and configure Tug in same configuration as for flight less ordnance hookup.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.47		FUNCTION TITLE: Combined System Test	
FUNCTION OBJECTIVE: Perform Kick Stage functional test in a simulated mission sequence.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>6</u> MIN <u>3</u>	
HAZARDOUS YES _____ NO <u>X</u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>8</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>2</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>2</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____	
GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>A-001, A-008</u>			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES		NEW PAGES <u>6</u> MANHOURS <u>36</u>	CHANGE <u>3</u> <u>9</u>
SOFTWARE REQUIREMENTS: LPS <input checked="" type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Kick Stage systems will be functionally operated in a similar sequence that the system would operate during a mission from countdown initiation through S/C separation sequence will be time compressed.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED: Facility Power			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.48		FUNCTION TITLE: Remove GSE - Prep to Mate with Tug	
FUNCTION OBJECTIVE:  Prep Kick Stage for Tug Mate			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>4</u> MIN <u>2</u>	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>  _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES <input checked="" type="checkbox"/> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY)  H-018, H-028  _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES <u>4</u> MANHOURS <u>24</u>	
		NEW <u>2</u> CHANGE <u>6</u>	
OPERATIONS:  Disconnect checkout GSE and perform final Kick Stage inspection. Connect handling GSE, hoist and move to Tug.			
REMARKS:  Hazardous due to hoisting.			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.49		FUNCTION TITLE: Prepare to Ship	
FUNCTION OBJECTIVE:  Prepare Tug for shipment to WTR			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>8</u> MIN <u>4</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH <u>3</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		HAZARDOUS. YES <u>X</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-020, H-024, H-023</u> _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>4</u> MANHOURS <u>24</u>	
		NEW <u>4</u> CHANGE <u>2</u> <u>6</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Attach handling sling, hoist, rotate to horizontal and place in cargo canister. Attach transportation instrumentation kit for transportation.			
REMARKS:  Hazardous because of Tug handling			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.50		FUNCTION TITLE: Move to Shuttle Airfield	
FUNCTION OBJECTIVE: Move Tug from TPF to Shuttle Airfield for loading and transport to WTR			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>6</u> MIN <u>4</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> <u>Transportation</u>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>2</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		HAZARDOUS YES <input checked="" type="checkbox"/> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) <u>H-024</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
		PROCEDURES PAGES <u>2</u> MANHOURS <u>12</u>	
		NEW <u>2</u> CHANGE <u>1</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Using the prime mover tow the Tug in the cargo canister to the Shuttle.			
REMARKS:  Hazardous because of transportation			
COMMODITIES/CONSUMABLES REQUIRED:  N/A			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.51		FUNCTION TITLE: Load on Aircraft and Ship to WTR	
FUNCTION OBJECTIVE:  Transport Tug from ETR to WTR			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>6</u> MIN <u>4</u>	
AREA LOCATION OLF <input checked="" type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>  _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>2</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> QUAL CONT. TECH _____ TECHNICAL SUPPORT _____  GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-022,</u> _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>  PROCEDURES PAGES <u>3</u> NEW <u>2</u> CHANGE MANHOURS <u>18</u> <u>6</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  <p>When the cargo canister transporter arrives at the Shuttle airfield it will be towed into the MDF. The pod will be detached from the transporter and raised to position at the top of the MDF. The empty canister transporter will be towed out of the MDF. The 747 will then be towed into the MDF and the cargo canister will be attached to the aircraft. The 747 with piggy-back cargo canister attached will be towed out of the MDF and to the airstrip for taxi and takeoff.</p>			
REMARKS:  Hazardous because of transportation			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 4.52		FUNCTION TITLE: Internal Area Cleaning	
FUNCTION OBJECTIVE:  Clean internal area to be compatible with cleanliness requirement.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>5</u> MIN <u>3</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>2</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES _____ NO <u>X</u>	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-026</u> _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>2</u> MANHOURS <u>12</u>	
		NEW <u>1</u> CHANGE <u>3</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Wipe down internal Kick Stage Areas and vacuum to meet cleanliness requirements.			
REMARKS:  Factory clean processing			
COMMODITIES/CONSUMABLES REQUIRED:  Cleaning Chemical			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.1		FUNCTION TITLE: Tug and Spacecraft Mate	
FUNCTION OBJECTIVE:  Mechanically mate the spacecraft to the Tug (kick stage)			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>12</u> MIN <u>4</u>	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input checked="" type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>7</u> <u>11**</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> <u>2**</u> PROPULSION TECH <u>1</u> <u>1**</u> MECH/STRU/TH TECH <u>3</u> AVIONICS TECH <u>1</u> <u>2**</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> <u>2**</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES <u>x</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>A-001, P-008</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>5</u> <u>3</u> MANHOURS <u>30</u> <u>9</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Connect LPS to energize pin pullers to the retract position and verify mate interface. Lift spacecraft into mate position and align attach points. Extend pin pullers to latch position and verify. Verify mechanical alignment.  A spacecraft simulator will be utilized to demonstrate Tug engineering model mate and electrical connection.			
REMARKS:  Hazardous due to hoisting operations and ordnance.			
COMMODITIES/CONSUMABLES REQUIRED:			



## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.2		FUNCTION TITLE: Load and Verify Computer Flight Software	
FUNCTION OBJECTIVE: Load Tug computer flight software			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>2</u> MIN <u>.25</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input checked="" type="checkbox"/> PCR <input checked="" type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>2</u> 6** TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH <u>1</u> 3** SAFETY ENGINEER _____ QUAL CONT. TECH <u>2</u> ** TECHNICAL SUPPORT _____	
		HAZARDOUS YES _____ NO <u>x</u>	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) <u>A-001, A-008, A-009</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input checked="" type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>3</u> MANHOURS <u>9</u>	
		NEW <u>1</u> CHANGE <u>3</u>	
SOFTWARE REQUIREMENTS: LPS <input checked="" type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS: Load Tug computer with flight program via LPS and verify proper response			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.3		FUNCTION TITLE: Connect S/C Simulator	
FUNCTION OBJECTIVE:  Verify docking/retrieval capability			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>3</u> MIN <u>2</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>3</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		HAZARDOUS YES <u>X</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-027, H-018</u> _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>3</u> MANHOURS <u>18</u>	
		NEW <u>2</u> CHANGE <u>6</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Hoist simulator and mate with Tug, verify capture and latching mechanism			
REMARKS: For service/retrieval mission assignments only. Hazardous due to hoisting operation.			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.4		FUNCTION TITLE: Functional Interface Test (FIT)	
FUNCTION OBJECTIVE:  Functionally verify all Tug/kick stage/spacecraft interfaces			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>16</u> MIN <u>4</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input checked="" type="checkbox"/> PCR <input checked="" type="checkbox"/> ORB <input type="checkbox"/>		HAZARDOUS YES <u>x</u> NO _____	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>12</u> <u>13**</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>2</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>4</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>2</u> TECHNICAL SUPPORT <u>1**</u> <u>Tech Writer</u>		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>A-001, A-008, A-011, A-012</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input checked="" type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input checked="" type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES <u>11</u> MANHOURS <u>66</u>	
OPERATIONS:  Verify single point ground and bus isolation. To the maximum extent possible, exercise all Tug/kick stage/spacecraft systems through the mission profile (liftoff through S/C separation) using the MSS/PSS flight hardware. Data will be monitored and compared to establish criteria for go, no-go conditions. All ordnance functions and separation latches will be monitored for proper event occurrence.		NEW <u>6</u> CHANGE <u>18</u>	
REMARKS:  Hazardous due to ordnance			
COMMODITIES/CONSUMABLES REQUIRED:  Facility power			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.5		FUNCTION TITLE: <b>Spacecraft to STDN/TDRSS/SCF</b> <b>Communication Verification (Open Loop)</b>	
FUNCTION OBJECTIVE:  Verify the payload uplink and downlink to each segment's controlling ground station.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>8</u> MIN <u>2</u>	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input checked="" type="checkbox"/> PCR <input checked="" type="checkbox"/> ORB <input type="checkbox"/>  _____ _____ _____		HAZARDOUS YES <u>x</u> NO _____	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH <u>2</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>A-001</u> _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input checked="" type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES <u>5</u> MANHOURS <u>30</u>	
		NEW <u>3</u> <u>9</u>	
OPERATIONS:  Each payload segment (Tug/kick stage/spacecraft) will be verified to be compatible with its respective ground station. Each station will execute commands and verify via RF open loop.			
REMARKS:  Hazardous due to on-board ordnance and S/C propellant.			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.6		FUNCTION TITLE: Payload to Orbiter Communications Verification (Open Loop)	
FUNCTION OBJECTIVE:  Verify RF compatibility between the orbiter and Tug communications systems.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>8</u> MIN <u>2</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input checked="" type="checkbox"/> PCR <input checked="" type="checkbox"/> ORB <input type="checkbox"/>   		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> 7** TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>1</u> 2** PROPULSION TECH <u>          </u> MECH/STRU/TH TECH <u>          </u> AVIONICS TECH <u>2</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT <u>          </u>	
		HAZARDOUS YES <u>x</u> NO <u>          </u>	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY)  A-001	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>4</u> MANHOURS <u>24</u>	
		NEW <u>2</u> CHANGE <u>6</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  After RF lock-on between Tug and Orbiter perform all mission communications routines. All normal commands and proper responses will be verified.			
REMARKS:  Hazardous due to on-board ordnance and spacecraft propellants			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.7		FUNCTION TITLE: Install Flight Battery	
FUNCTION OBJECTIVE:  Install and Connect Flight Battery			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>4</u> MIN <u>1.5</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input checked="" type="checkbox"/> PCR <input checked="" type="checkbox"/> ORB <input type="checkbox"/>   		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5 6**</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH <u>1 2**</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES <u>x</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>A-001, H-021</u>   	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>2</u> MANHOURS <u>12</u>	
		NEW <u>2</u> <u>12</u>	
		CHANGE <u>1</u> <u>3</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Remove battery from storage and verify battery at full capacity. Install on Tug and connect to distribution system.  A GSE battery will be utilized for Tug engineering model checkout.			
REMARKS:  Hazardous due to ordnance and spacecraft propellants.			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.8		FUNCTION TITLE: Connect Ordnance and Verify Safe	
FUNCTION OBJECTIVE:  Perform final ordnance connections			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>4</u> MIN <u>2</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input checked="" type="checkbox"/> PCR <input checked="" type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		HAZARDOUS YES <u>x</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>Electronic equipment</u> _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>4</u> MANHOURS <u>24</u>	
		NEW <u>2</u> CHANGE <u>6</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Verify no current at each ordnance connector with power on/off, connect ordnance interface connectors. Verify ordnance items in safe configuration.  For kick stage (when installed) verify safety pin is in place on safe and arm device.			
REMARKS:  Hazardous due to ordnance and spacecraft propellants			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.9		FUNCTION TITLE: Move to APS Propellant Loading Bay	
FUNCTION OBJECTIVE:  Transport Payload to $N_2H_4$ Loading Area			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>6</u> MIN <u>2</u>	
HAZARDOUS YES <u>x</u> NO <u>      </u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input checked="" type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>   		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>4</u> 11** TEST CONDUCTOR <u>      </u> TEST ENGINEERS <u>1</u> 2** PROPULSION TECH <u>      </u> 2** MECH/STRU/TH TECH <u>      </u> 2** AVIONICS TECH <u>      </u> 2** SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>      </u> 2** TECHNICAL SUPPORT <u>      </u>	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-025, H-018</u>   			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES		NEW PAGES <u>2</u> MANHOURS <u>12</u>	CHANGE <u>1</u> <u>3</u>
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:          Hoist payload from Tug workstands and move to APS fueling bay and install in workstand.			
REMARKS:  Hazardous due to ordnance and S/C propellants. Loading area will be temporarily secured for DOD upper segments.			
COMMODITIES/CONSUMABLES REQUIRED:			



## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.10		FUNCTION TITLE: Partial Tug Pressurant Load	
FUNCTION OBJECTIVE: Pressurize Tug pressurization system to 1/3 flight pressure			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>6</u> MIN <u>1.5</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input checked="" type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		HAZARDOUS YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>7</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>2</u> MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT <u>1</u>		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) <u>A-005, P-011, P-016</u>	
		PROCEDURES PAGES <u>4</u> MANHOURS <u>24</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Connect pressurization GSE and LPS. Pressurize Tug pressurization system to 1100 psi.			
REMARKS: Hazardous because of ordnance, spacecraft propellants and pressurization			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.11		FUNCTION TITLE: Load APS, Leak Check and Secure	
FUNCTION OBJECTIVE:  Load APS Propellant			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>12</u> MIN <u>.5</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input checked="" type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>7</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>2</u> MECH/STRU/TH TECH <u>      </u> AVIONICS TECH <u>1</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT <u>      </u>	
		HAZARDOUS YES <u>x</u> NO <u>      </u>	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) <u>P-018, P-011</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>3</u> MANHOURS <u>18</u>	
		NEW <u>1</u> CHANGE <u>3</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Evacuate propellant side of APS system and charge with $N_2H_4$ , pressurize pressure side and verify no system leakage.  Tug engineering model will be unloaded, flushed and purged to safe level.			
REMARKS:  Hazardous due to ordnance, propellant and pressures. Protective clothing required.			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.12		FUNCTION TITLE: Prep to Move	
FUNCTION OBJECTIVE:  Prepare Tug to Move			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>12</u> MIN <u>1</u>	
HAZARDOUS YES _____ NO <u>x</u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input checked="" type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>3</u> AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>P-009, H-025, H-004</u> _____ _____			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES		NEW PAGES <u>3</u>	CHANGE <u>2</u>
		MANHOURS <u>18</u>	<u>6</u>
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS: Verify all checkout GSE has been removed, and all pressurized systems are tagged. Attach handling GSE and verify Tug is clear to be hoisted. Perform Tug final inspection prior to movement. Seal canister to facility door.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.13		FUNCTION TITLE: Install on Transporter and Cover										
FUNCTION OBJECTIVE:  Place Tug on Transporter and Cover												
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>4</u> MIN <u>2</u>										
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input checked="" type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>   		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>2</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> QUAL CONT. TECH _____ TECHNICAL SUPPORT _____										
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>										
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		HAZARDOUS YES <u>x</u> NO _____  GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-019, H-004, H-0018</u>    <table border="1"> <thead> <tr> <th>PROCEDURES</th> <th>NEW</th> <th>CHANGE</th> </tr> </thead> <tbody> <tr> <td>PAGES</td> <td><u>2</u></td> <td><u>1</u></td> </tr> <tr> <td>MANHOURS</td> <td><u>12</u></td> <td><u>3</u></td> </tr> </tbody> </table>		PROCEDURES	NEW	CHANGE	PAGES	<u>2</u>	<u>1</u>	MANHOURS	<u>12</u>	<u>3</u>
PROCEDURES	NEW	CHANGE										
PAGES	<u>2</u>	<u>1</u>										
MANHOURS	<u>12</u>	<u>3</u>										
OPERATIONS:  Lift Tug from Tug workstands, rotate to horizontal and install on transporter. If Tug is to be transported out of clean area install clean transport cover.												
REMARKS:  Hazardous due to hoisting and movement.												
COMMODITIES/CONSUMABLES REQUIRED:												

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.14		FUNCTION TITLE: Move to S/C Checkout Area	
FUNCTION OBJECTIVE:  Transport Tug to S/C checkout area			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>4</u> MIN <u>3</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> <u>Transport</u>		PERSONNEL (HEAD/ JUNT) TOTAL MANPOWER <u>2</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		HAZARDOUS YES <u>x</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY)  GFE  H-004, H-019	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES <u>2</u> MANHOURS <u>12</u>	
		NEW <u>1</u> CHANGE <u>3</u>	
OPERATIONS:  Attach prime mover and tow Tug to the S/C checkout area and disconnect prime mover. Hoist Tug and rotate to vertical, position Tug in workstand.			
REMARKS:  Hazardous due to transportation			
COMMODITIES/CONSUMABLES REQUIRED:			

FUNCTION NO: 5.15		FUNCTION TITLE: Prepare to Mate with Spacecraft	
FUNCTION OBJECTIVE:  Ready Tug for S/C Mate			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>2</u> MIN <u>1</u>	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input checked="" type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>   		HAZARDOUS YES _____ NO <u>x</u>  PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>4</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH <u>3</u> AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-019, A-004</u>   	
OPERATIONS:  Verify Tug in clean environment and remove transportation cover. Verify Tug orientation and interface are ready for mate.		PROCEDURES PAGES <u>1</u> MANHOURS <u>6</u>	
REMARKS:		NEW <u>1</u> <u>3</u>	
COMMODITIES/CONSUMABLES REQUIRED:		CHANGE <u>1</u> <u>3</u>	

FUNCTION NO: 5.16		FUNCTION TITLE:	
FUNCTION OBJECTIVE:  Left blank intentionally			
SITE LOCATION ETR <input type="checkbox"/> WTR <input type="checkbox"/>	TIME TO COMPLETE (HRS) MAX _____ MIN _____	HAZARDOUS YES _____ NO _____	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____	PERSONNEL (HEADCOUNT) TOTAL MANPOWER _____ TEST CONDUCTOR _____ TEST ENGINEERS _____ PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____ _____ _____	GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input type="checkbox"/>	PROCEDURES PAGES _____ MANHOURS _____
NEW CHANGE			
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.17		FUNCTION TITLE: Install Tug in Canister	
FUNCTION OBJECTIVE:  Place Tug in Canister			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>8</u> MIN <u>3.5</u>	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input checked="" type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		HAZARDOUS YES <u>X</u> NO <u>      </u>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5</u> TEST CONDUCTOR <u>      </u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>      </u> MECH/STRU/TH TECH <u>2</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>      </u> TECHNICAL SUPPORT <u>      </u>		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-018</u> <u>GFE Canister</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES		NEW PAGES <u>3</u> MANHOURS <u>18</u>	CHANGE <u>2</u> <u>6</u>
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Disconnect pressure/propellant loading GSE, attach handling equipment. Hoist Tug from workstand and place in the canister bay.			
REMARKS:  Hazardous due to ordnance, propellant and hoisting operations			
COMMODITIES/CONSUMABLES REQUIRED:			



## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.18		FUNCTION TITLE: Verify Canister Environment, Move to Pad and Spot	
FUNCTION OBJECTIVE:  Move Tug to Pad			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>20</u> MIN <u>8</u>	
		HAZARDOUS YES <u>x</u> NO <u>      </u>	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> IPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>   		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>2</u> TEST CONDUCTOR <u>      </u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>      </u> MECH/STRU/TH TECH <u>      </u> AVIONICS TECH <u>      </u> SAFETY ENGINEER <u>1</u> / <u>      </u> QUAL CONT. TECH <u>      </u> TECHNICAL SUPPORT <u>      </u>	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY)  <u>GFE</u>   	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>6</u> MANHOURS <u>36</u>	
		NEW <u>3</u> CHANGE <u>9</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Seal canister doors and end cap and establish controlled environment. Attach prime mover to transporter and transfer to pad. Roll into PCR bay and position canister for PCR mating.			
REMARKS:  Hazardous due to ordnance, propellants and transportation			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.19		FUNCTION TITLE: Install Canister with PCR and Place Tug on Manipulator	
FUNCTION OBJECTIVE:  Install Tug in PCR Payload Manipulator			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX 8 MIN 5	
		HAZARDOUS YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input checked="" type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER 2 TEST CONDUCTOR _____ TEST ENGINEERS 1 PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER 1 QUAL CONT. TECH _____ TECHNICAL SUPPORT _____ _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) GFE _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input checked="" type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES 5 MANHOURS 30	
		NEW 3 9	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Inflate canister seal, open PCR hatch, and verify clean environment. Remove canister end cover and hoist payload from canister. Place Tug on manipulator and secure.			
REMARKS:  Hazardous due to ordnance, propellant, hoisting			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.20		FUNCTION TITLE: Remove Canister	
FUNCTION OBJECTIVE:  Remove Canister from PCR			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>5.0</u> MIN <u>3.0</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input checked="" type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>2</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		HAZARDOUS YES <u>x</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY)  GFE _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>2</u> MANHOURS <u>12</u>	
		NEW <u>1</u> CHANGE <u>3</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Deflate canister seal. Lower canister and place it in roll-back position. Remove and stow canister.			
REMARKS:  Hazardous due to hoisting and movement			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.21		FUNCTION TITLE: Tug and Spacecraft Mate	
FUNCTION OBJECTIVE: Mechanically mate the Spacecraft to the Tug (Kick Stage)			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>8</u> MIN <u>4</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input checked="" type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH <u>2</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES <input checked="" type="checkbox"/> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>A-001</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES <u>5</u> MANHOURS <u>30</u>	
		NEW <u>3</u> CHANGE <u>9</u>	
OPERATIONS:  Connect LPS to energize pin puller to the retracted position and verify mate interface. Lift spacecraft into mate position and align attach points. Extend pin pullers to latch position and verify. Verify mechanical alignment.			
REMARKS:  Hazardous due to hoisting operations and ordnance			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.22		FUNCTION TITLE: Move to PCU	
FUNCTION OBJECTIVE: Move Tug from OLF to PCU for receiving and inspection activities.			
SITE LOCATION ETR <input type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>2</u> MIN <u>1</u>	
HAZARDOUS YES <u>x</u> NO <u>      </u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input checked="" type="checkbox"/> ORB <input type="checkbox"/> <u>Transportation</u>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>4</u> TEST CONDUCTOR <u>      </u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>      </u> MECH/STRU/TH TECH <u>2</u> AVIONICS TECH <u>      </u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>      </u> TECHNICAL SUPPORT <u>      </u>	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-025, H-018, H-029, H-024, H-019</u>			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
PROCEDURES		NEW PAGES <u>2</u> MANHOURS <u>12</u>	CHANGE <u>1</u> <u>3</u>
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS: Using the prime mover tow the Tug in the cargo canister to the PCU. Remove transportation cover and attach handling equipment. Hoist Tug from cargo canister, rotate to vertical and place in vertical workstand. Remove Tug access and inspection panels.			
REMARKS: Hazardous due to transportation			
COMMODITIES/CONSUMABLES REQUIRED:  N/A			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.23		FUNCTION TITLE: Move into Elevator and Elevate to PCR	
FUNCTION OBJECTIVE: Move payload to PCR			
SITE LOCATION ETR <input type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>4</u> MIN <u>2</u>	
HAZARDOUS YES <u>x</u> NO <u>      </u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>   		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5</u> TEST CONDUCTOR <u>      </u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>      </u> MECH/STRU/TH TECH <u>3</u> AVIONICS TECH <u>      </u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>      </u> TECHNICAL SUPPORT <u>      </u>	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) <u>H-018, H-029</u>			
PROCEDURES		NEW <u>4</u>	CHANGE <u>2</u>
PAGES		<u>24</u>	<u>6</u>
MANHOURS			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input checked="" type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Attach handling equipment, hoist payload from vertical workstand and place on elevator fixture. Raise elevator to PCR level.			
REMARKS:  Hazardous because of Tug handling			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.24		FUNCTION TITLE: Mate to Manipulator, Remove Non-Flight Hardware	
FUNCTION OBJECTIVE:  Install payload in PCR			
SITE LOCATION ETR <input type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>4</u> MIN <u>2</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input checked="" type="checkbox"/> ORB <input type="checkbox"/>		HAZARDOUS YES <u>x</u> NO <u>      </u>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>4</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>      </u> PROPULSION TECH <u>      </u> MECH/STRU/TH TECH <u>2</u> AVIONICS TECH <u>      </u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>      </u> TECHNICAL SUPPORT <u>      </u>		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-018, H-029</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input checked="" type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES <u>4</u> MANHOURS <u>24</u>	
		NEW <u>2</u> CHANGE <u>6</u>	
OPERATIONS:  Move manipulator into position and lift payload from elevator fixture and position for PCR-Orbiter mate. Remove non-flight item from payload.			
REMARKS:  Hazardous because of payload handling			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.25	FUNCTION TITLE: Establish 100K Clean Room		
FUNCTION OBJECTIVE: Establish 100K environment to facilitate payload mate and integrated checkout.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>	TIME TO COMPLETE (HRS) MAX <u>7</u> MIN <u>3</u>		HAZARDOUS YES _____ NO <u>X</u>
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____	PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>3</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH <u>1</u> AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____
	TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		PROCEDURES PAGES <u>4</u> MANHOURS <u>24</u>
TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>		CHANGE <u>2</u> <u>6</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  After Payload is mated, the clean room is closed up and 100K environment is established.			
REMARKS:  Factory clean processing			
COMMODITIES/CONSUMABLES REQUIRED:  100K Conditioned Air			



## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 5.26		FUNCTION TITLE: External Surface Cleaning	
FUNCTION OBJECTIVE:  Clean external surfaces to be compatible with cleanliness requirements.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>6</u> MIN <u>3</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>2</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____ _____ _____	
		HAZARDOUS YES _____ NO <u>X</u>	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>4</u> MANHOURS <u>24</u>	
		NEW <u>2</u> <u>6</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Wipe down external surfaces of Tug with cleaning chemical to meet cleanliness requirements.			
REMARKS:  Factory clean processing			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: <b>6.1</b>		FUNCTION TITLE: <b>Install Payload in Canister</b>	
FUNCTION OBJECTIVE:  <b>Place Payload in Canister</b>			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>8</u> MIN <u>3.5</u>	
HAZARDOUS YES, <u>x</u> NO <u>          </u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>   		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>9 15**</u> TEST CONDUCTOR <u>          </u> TEST ENGINEERS <u>1 3**</u> PROPULSION TECH <u>2</u> MECH/STRU/TH TECH <u>3</u> AVIONICS TECH <u>1 2**</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1 4**</u> TECHNICAL SUPPORT <u>          </u>	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <b>H-018, H-031 (Alt)</b>			
GFE   			
PROCEDURES PAGES <u>3</u> MANHOURS <u>18</u>		NEW <u>2</u> CHANGE <u>6</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  <b>Disconnect pressure/propellant loading GSE, attach handling equipment. Hoist payload from workstand and place in the canister bay.</b>  <b>Alternate: Uses manipulator (H-031) to attach to payload and place in canister.</b>			
REMARKS:  <b>Hazardous due to ordnanace, propellant and hoisting operations.</b>			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: <b>5.2</b>		FUNCTION TITLE: <b>Verify Cannister Environment, Move to Pad and Spot.</b>	
FUNCTION OBJECTIVE:  <b>Deliver payload to pad</b>			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>20</u> MIN <u>8</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> <u>Launch Pad</u>		HAZARDOUS YES <u>x</u> NO <u>      </u>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>2</u> TEST CONDUCTOR <u>      </u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>      </u> MECH/STRU/TH TECH <u>      </u> AVIONICS TECH <u>      </u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>      </u> TECHNICAL SUPPORT <u>      </u>		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>GFE equipment</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES <u>6</u> MANHOURS <u>36</u>	
		NEW <u>3</u> CHANGE <u>9</u>	
OPERATIONS:  <b>Seal canister doors and end cap and establish controlled environment. Attach prime mover to transporter and transfer to pad. Roll into PCR bay and position canister for PCR mating.</b>			
REMARKS:  <b>Hazardous due to ordnance, propellants and transportation.</b>			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: <b>6.3</b>		FUNCTION TITLE: <b>Install Canister with PCR and Place Payload on Manipulator</b>	
FUNCTION OBJECTIVE:  <b>Install Payload in PCR.</b>			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>16</u> MIN <u>5</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input checked="" type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		HAZARDOUS YES <u>X</u> NO _____  PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>2 6**</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH <u>2**</u> AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>2**</u> TECHNICAL SUPPORT _____ _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input checked="" type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>  GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) <u>GFE Equipment</u> _____ _____ _____	
		PROCEDURES PAGES <u>5</u> MANHOURS <u>30</u>	
		NEW <u>3</u> CHANGE <u>9</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  <b>Inflate canister seal, open PCR hatch, and verify clean environment.          Place payload on manipulator and secure.</b>			
REMARKS:  <b>Hazardous due to ordnanace, propellant, hoisting</b>			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 6.4	FUNCTION TITLE: Remove non-flight hardware Remove Cannister									
FUNCTION OBJECTIVE:  Verify P/L in stowed position and prepared for PCR - Orbiter mate										
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>	TIME TO COMPLETE (HRS) MAX <u>8</u> MIN <u>4</u>	HAZARDOUS YES <u>x</u> NO <u>      </u>								
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input checked="" type="checkbox"/> ORB <input type="checkbox"/>   	PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>7</u> TEST CONDUCTOR <u>      </u> TEST ENGINEERS <u>1</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>2</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT <u>      </u>	GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY)  GFE equipment								
	<table border="1"> <thead> <tr> <th>PROCEDURES</th> <th>NEW</th> <th>CHANGE</th> </tr> </thead> <tbody> <tr> <td>PAGES</td> <td><u>4</u></td> <td><u>2</u></td> </tr> <tr> <td>MANHOURS</td> <td><u>24</u></td> <td><u>6</u></td> </tr> </tbody> </table>		PROCEDURES	NEW	CHANGE	PAGES	<u>4</u>	<u>2</u>	MANHOURS	<u>24</u>
PROCEDURES	NEW	CHANGE								
PAGES	<u>4</u>	<u>2</u>								
MANHOURS	<u>24</u>	<u>6</u>								
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input checked="" type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>								
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>										
OPERATIONS:  Establish payload in latched position with all non-flight hardware removed. Deflate canister seal and lower canister and place it in roll-back position.										
REMARKS:  Hazardous due to ordnance, propellant and hoisting										
COMMODITIES/CONSUMABLES REQUIRED:										

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 6.5		FUNCTION TITLE: Extend PCR and Open P/L Bay Doors	
FUNCTION OBJECTIVE:  Extend PCR to orbiter mate position and establish clean environment			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>8</u> MIN <u>1</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input checked="" type="checkbox"/> ORB <input type="checkbox"/>   		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>2</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		HAZARDOUS YES <u>X</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input checked="" type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>3</u> MANHOURS <u>18</u>	
		NEW <u>2</u> <u>6</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Extend PCR to mate backoff position; lower panel seals, lower servicing platform and install work platforms, wipe down orbiter seals, orbiter doors and PCR/orbiter seals, inch PCR into mate position. Remove work platforms and open PCR doors. Verify orbiter bay doors open and establish common clean environment.			
REMARKS:  Hazardous due to ordnance, propellant and movement.			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 6.6		FUNCTION TITLE: Mate Payload with Orbiter	
FUNCTION OBJECTIVE:  Mechanically mate payload with orbiter			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>16</u> MIN <u>2.5</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input checked="" type="checkbox"/> ORB <input type="checkbox"/>  _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>10</u> <u>13**</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>2</u> PROPULSION TECH <u>1</u> <u>2**</u> MECH/STRU/TH TECH <u>2</u> AVIONICS TECH <u>1</u> <u>2**</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>2</u> <u>3**</u> TFCHNICAL SUPPORT _____	
		HAZARDOUS YES <u>x</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY)  _____ _____ _____	
TUG INTERFACE: OPBITER <input checked="" type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>3</u> MANHOURS <u>18</u>	
		NEW <u>2</u> CHANGE <u>6</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Extend manipulator to backoff position; align attach points with P/L guides, and verify interface connectors ready for mate. Inch manipulator to mate position and verify payload Trunnions and retention system in latched position. Verify that payload clearance envelope has not been violated. Mate all interface connections.			
REMARKS: Hazardous due to ordnance, propellants and movement			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: <b>6.7</b>		FUNCTION TITLE: <b>Payload-Orbiter Interface Verification</b>	
FUNCTION OBJECTIVE:  <b>Verify payload-orbiter interface integrity</b>			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (H:M:S) MAX <u>12</u> MIN <u>3.5</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input checked="" type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>13</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>2</u> PROPULSION TECH <u>3</u> MECH/STRU/TH TECH <u>      </u> AVIONICS TECH <u>4</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>2</u> TECHNICAL SUPPORT <u>      </u>	
		HAZARDOUS YES <u>x</u> NO <u>      </u>	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY)  <u>P-009</u>	
TUG INTERFACE: ORBITER <input checked="" type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>15</u> MANHOURS <u>90</u>	
		NEW <u>8</u> CHANGE <u>24</u>	
SOFTWARE REQUIREMENTS: LPS <input checked="" type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Conduct leak test (decay) on each propellant/pressurant line crossing orbiter interface from facility interface to adapter valves. Perform continuity checks and inspection on each electrical connector at the orbiter and facility interface. Apply power to the Tug primary bus. Utilize the LPS to address and verify response to each P/L computer. Establish propellant tank insulation purge. Verify all P/L related orbiter/facility interface connectors mated.			
REMARKS:  <b>Hazardous due to ordnance and propellants</b>			
COMMODITIES/CONSUMABLES REQUIRED:			



## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 6.8		FUNCTION TITLE: Payload Measurement Profile	
FUNCTION OBJECTIVE:  Establish pre-launch data baseline profile			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>2</u> MIN <u>0.1</u>	
HAZARDOUS YES <u>x</u> NO _____			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input checked="" type="checkbox"/> _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH <u>1</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____	
GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____			
TUG INTERFACE: ORBITER <input checked="" type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES		NEW PAGES <u>2</u> MANHOURS <u>12</u>	CHANGE <u>1</u> <u>3</u>
SOFTWARE REQUIREMENTS: LPS <input checked="" type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Power up the complete payload and record the ambient end instrument profiles.			
REMARKS:  Hazardous due to ordnanace and propellants			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 6.9		FUNCTION TITLE: Orbiter - P/L Functional Interface Systems Test	
FUNCTION OBJECTIVE:  Verify that the P/L and Orbiter are ready to support the mission,			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>8</u> MIN <u>3</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input checked="" type="checkbox"/>		HAZARDOUS YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>12</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>2</u> PROPULSION TECH <u>2</u> MECH/STRU/TH TECH <u>2</u> AVIONICS TECH <u>4</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>2</u> TECHNICAL SUPPORT <u>      </u>		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY)          	
		PROCEDURES PAGES <u>5</u> MANHOURS <u>30</u>	
TUG INTERFACE: ORBITER <input checked="" type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input checked="" type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Perform an abbreviated mission sequence test from launch through orbiter landing.  For kick stage - remove safe and arm device safety pin.			
REMARKS:  Hazardous due to ordnance and propellants			
COMMODITIES/CONSUMABLES REQUIRED:			

FUNCTION NO: 6.10		FUNCTION TITLE: Remove non-Flight Hardware	
FUNCTION OBJECTIVE:  Prepare for PCR-Orbiter Mate			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>5</u> MIN <u>3</u>	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input checked="" type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>2</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH <u>1</u> AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		HAZARDOUS YES _____ NO <u>X</u>	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>1</u> MANHOURS <u>6</u>	
		NEW <u>1</u> CHANGE <u>1</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:   Remove non-flight hardware from Tug and Spacecraft as required.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 7.1		FUNCTION TITLE: Tug Pressurant and Fuel Cell Loading	
FUNCTION OBJECTIVE:  Complete Tug Pressurant Loading and Load Fuel Cell Reactants			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>12</u> MIN <u>4</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input checked="" type="checkbox"/>   		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>10</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>2</u> PROPULSION TECH. <u>4</u> MECH/STRU/TH TECH <u>1</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT <u>1</u>	
		HAZARDOUS. YES <u>X</u> NO <u>      </u>	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY)   	
TUG INTERFACE: ORBITER <input checked="" type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input checked="" type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES <u>6</u> MANHOURS <u>36</u>	
		NEW <u>3</u> CHANGE <u>9</u>	
OPERATIONS:  Complete helium pressurant loading to 3200 psi via orbiter interface. Load fuel cell LH <sub>2</sub> and LO <sub>2</sub> and top as required.  Pressurize main propellant tanks to flight pressure and leak check (decay).			
REMARKS:  Hazardous due to ordnance, propellants and pressures. Purge bag purge must be on.			
COMMODITIES/CONSUMABLES REQUIRED:  Helium, LO <sub>2</sub> , LH <sub>2</sub>			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: <b>7.2</b>	FUNCTION TITLE: <b>Countdown</b>										
FUNCTION OBJECTIVE:  <b>Load Tug Propellants</b>											
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>	TIME TO COMPLETE (HRS) MAX <u>4</u> MIN <u>1</u>	HAZARDOUS YES <u>x</u> NO <u>      </u>									
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input checked="" type="checkbox"/>   	PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>11</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>3</u> PROPULSION TECH <u>3</u> MECH/STRU/TH TECH <u>      </u> AVIONICS TECH <u>2</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT <u>      </u>	GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY)   									
	<table border="1"> <tr> <td>TUG INTERFACE: ORBITER <input checked="" type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/></td> <td>TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/></td> </tr> </table>		TUG INTERFACE: ORBITER <input checked="" type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>	TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>							
TUG INTERFACE: ORBITER <input checked="" type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>	TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>										
		<table border="1"> <tr> <td>PROCEDURES</td> <td>NEW</td> <td>CHANGE</td> </tr> <tr> <td>PAGES</td> <td><u>17</u></td> <td><u>9</u></td> </tr> <tr> <td>MANHOURS</td> <td><u>102</u></td> <td><u>27</u></td> </tr> </table>	PROCEDURES	NEW	CHANGE	PAGES	<u>17</u>	<u>9</u>	MANHOURS	<u>102</u>	<u>27</u>
PROCEDURES	NEW	CHANGE									
PAGES	<u>17</u>	<u>9</u>									
MANHOURS	<u>102</u>	<u>27</u>									
SOFTWARE REQUIREMENTS: LPS <input checked="" type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>											
OPERATIONS:  Cooldown Tug LH <sub>2</sub> tank and slow fill, rapid fill to upper sensor, slow fill to full then top.  Cooldown Tug LO <sub>2</sub> tank and slow fill, rapid fill to upper sensor, slow fill to full then top.											
REMARKS:  Hazardous due to propellants, ordnance and pressures. Purge bag purge must be on.											
COMMODITIES/CONSUMABLES REQUIRED:  LO <sub>2</sub> , LH <sub>2</sub>											

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: <b>7.3</b>		FUNCTION TITLE: <b>Terminal Countdown and Launch</b>	
FUNCTION OBJECTIVE:  <b>Launch Shuttle</b>			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>4</u> MIN <u>1</u>	
		HAZARDOUS YES <u>x</u> NO <u>      </u>	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input checked="" type="checkbox"/>   		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> TEST CONDUCTOR <u>1</u> TEST ENGINEERS <u>3</u> PROPULSION TECH <u>      </u> MECH/STRU/TH TECH <u>      </u> AVIONICS TECH <u>      </u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT <u>      </u>	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY)    	
TUG INTERFACE: ORBITER <input checked="" type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>20</u> NEW <u>10</u> MANHOURS <u>120</u> CHANGE <u>30</u>	
SOFTWARE REQUIREMENTS: LPS <input checked="" type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  <b>Monitor Tug critical parameters thru liftoff to verify "GO" condition.</b>  <b>For engineering model monitor Tug critical parameters through abbreviated launch countdown to verify interfaces and software.</b>			
REMARKS:  <b>Hazardous due to propellant, ordnance and pressures</b>			
COMMODITIES/CONSUMABLES REQUIRED:  <b>LH<sub>2</sub>, LO<sub>2</sub></b>			

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FUNCTION NO: 7.4*		FUNCTION TITLE: Offload and Purge Cryogenic Systems	
FUNCTION OBJECTIVE: Safe Tug engineering model propellant and fuel cell systems for removal from Orbiter bay.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>6</u> MIN <u>4</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input checked="" type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>11*</u> TEST CONDUCTOR <u>1*</u> TEST ENGINEERS <u>3*</u> PROPULSION TECH <u>3*</u> MECH/STRU/TH TECH <u>      </u> AVIONICS TECH <u>2*</u> SAFETY ENGINEER <u>1*</u> QUAL CONT. TECH <u>1*</u> TECHNICAL SUPPORT <u>      </u>	
		HAZARDOUS YES <u>x</u> NO <u>      </u>	
		GROUND SUPPORT EQUIPMENT LPS <input checked="" type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) <u>      </u> <u>      </u> <u>      </u> <u>      </u>	
TUG INTERFACE: ORBITER <input checked="" type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>17</u> MANHOURS <u>102</u>	
		NEW <u>9</u> <u>27</u>	
SOFTWARE REQUIREMENTS: LPS <input checked="" type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Dump LO <sub>2</sub> and LH <sub>2</sub> , purge cryogenic system until concentrations are within specified safety limits.			
REMARKS: Hazardous due to propellants * Engineering model only			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 7.5*		FUNCTION TITLE: Remove Payload from Orbiter Bay	
FUNCTION OBJECTIVE: Verify ability to remove a payload from the Orbiter			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>12</u> MIN <u>6</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input checked="" type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>9*</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>2*</u> PROPULSION TECH _____ MECH/STRU/TH TECH <u>4*</u> AVIONICS TECH _____ SAFETY ENGINEER <u>1*</u> QUAL CONT. TECH <u>2*</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES <u>x</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>2</u> <u>2</u> MANHOURS <u>12</u> <u>6</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Extend PCR, open Orbiter bay doors and verify seal. Install work platforms, mate manipulator to payload.			
REMARKS:  * Engineering model only			
COMMODITIES/CONSUMABLES REQUIRED:			



## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: <b>7.6*</b>		FUNCTION TITLE: <b>Install Engineering Model in Canister</b>	
FUNCTION OBJECTIVE: <b>Remove payload from Orbiter and move to TPF</b>			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>12</u> MIN <u>2</u>	
HAZARDOUS YES <u>x</u> NO <u>          </u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input checked="" type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>2*</u> TEST CONDUCTOR <u>          </u> TEST ENGINEERS <u>1*</u> PROPULSION TECH <u>          </u> MECH/STRU/TH TECH <u>1*</u> AVIONICS TECH <u>          </u> SAFETY ENGINEER <u>          </u> QUAL CONT. TECH <u>          </u> TECHNICAL SUPPORT <u>          </u>	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) <b>Canister and Transporter</b>			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input checked="" type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES		NEW PAGES <u>6</u>	CHANGE <u>4</u>
		MANHOURS <u>36</u>	<u>12</u>
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  <b>Remove payload from Orbiter bay, close bay doors, seal and retract PCR, mate canister to PCR, load payload in canister, seal canister and verify environment. Remove canister from PCR and move to TPF.</b>			
REMARKS: <b>Hazardous due to movement. * Engineering model only</b>			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 7.7*		FUNCTION TITLE: Remove Payload from Canister	
FUNCTION OBJECTIVE:  Remove Engineering Model from Canister			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>8</u> MIN <u>2</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>   		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>7*</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1*</u> PROPULSION TECH _____ MECH/STRU/TH TECH <u>4*</u> AVIONICS TECH _____ SAFETY ENGINEER <u>1*</u> QUAL CONT. TECH <u>1*</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES <u>x</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY)  <u>Canister, H-031</u>   	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>2</u> NEW MANHOURS <u>12</u> CHANGE <u>1</u> <u>3</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Connect canister to airlock, open doors, attach manipulator to Tug, remove payload and place in workstand. Remove canister.			
REMARKS: * Engineering model only			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 7.8*		FUNCTION TITLE: Service Engineering Model Cryo Tanks	
FUNCTION OBJECTIVE:  Safe Systems			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>7</u> MIN <u>3</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5*</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1*</u> PROPULSION TECH <u>2*</u> MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER <u>1*</u> QUAL CONT. TECH <u>1*</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES <u>x</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY)  <u>P-002</u> _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>4</u> <u>NEW</u> <u>2</u> <u>CHANGE</u> MANHOURS <u>24</u> <u>6</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Connect cryo servicing GSE. Purge LH <sub>2</sub> and LO <sub>2</sub> tanks and verify empty. Pressurize tanks to 19 ± 1 psia and lock up. Disconnect GSE.			
REMARKS:  Hazardous because of propellant *Engineering model only			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 7.9*		FUNCTION TITLE: Move payload to Second Checkout Cell Workstand	
FUNCTION OBJECTIVE:  Position payload in second checkout cell to perform GSE verification			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>10</u> MIN <u>3</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		HAZARDOUS YES <u>x</u> NO <u>      </u>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>9*</u> TEST CONDUCTOR <u>1*</u> TEST ENGINEERS <u>      </u> PROPULSION TECH <u>      </u> MECH/STRU/TH TECH <u>6*</u> AVIONICS TECH <u>      </u> SAFETY ENGINEER <u>1*</u> QUAL CONT. TECH <u>1*</u> TECHNICAL SUPPORT <u>      </u>		GROUND SUPP RT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY)  <u>H-31</u>	
		PROCEDURES NEW <u>3</u> CHANGE <u>2</u> PAGES <u>      </u> MANHOURS <u>18</u> <u>6</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input checked="" type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Attach manipulator to Tug hard points; move payload to second cell and install.			
REMARKS:  Hazardous because of hoisting/movement * Engineering model only			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 7.10*		FUNCTION TITLE: Verify Payload/GSE Interface	
FUNCTION OBJECTIVE:  Verify GSE interfaces are identical to those of other checkout cell			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>10</u> MIN <u>2</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>10*</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>2*</u> PROPULSION TECH <u>1*</u> MECH/STRU/TH TECH <u>2*</u> AVIONICS TECH <u>3*</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>2*</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES _____ NO <u>x</u> _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input checked="" type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>4</u> <u>2</u> MANHOURS <u>24</u> <u>6</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Connect electrical cabling and pneumatic lines; position GSE (platforms, stands, handling equipment, etc.) Verify interfaces. Disconnect all GSE and remove mechanical equipment.			
REMARKS:  * Engineering model only.			
COMMODITIES/CONSUMABLES REQUIRED:			

FUNCTION NO: 7.11*		FUNCTION TITLE: Remove Spacecraft Mechanical Simulator	
FUNCTION OBJECTIVE:  Demate spacecraft simulator and Tug			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>4</u> MIN <u>2</u>	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		HAZARDOUS YES, <u>x</u> NO <u>          </u>	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5*</u> TEST CONDUCTOR <u>          </u> TEST ENGINEERS <u>1*</u> PROPULSION TECH <u>          </u> MECH/ELETRU/TH TECH <u>2*</u> AVIONICS TECH <u>          </u> SAFETY ENGINEER <u>1*</u> QUAL CONT. TECH <u>1*</u> TECHNICAL SUPPORT <u>          </u>		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-019, H-026, A-001</u>	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES <u>12</u> MANHOURS <u>72</u>	
OPERATIONS:  Attach spacecraft handling equipment. Mechanically demate spacecraft and Tug. Hoist and move spacecraft away from Tug.		NEW <u>6</u> CHANGE <u>18</u>	
REMARKS:  Hazardous due to hoisting * Engineering model only			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 7.12*		FUNCTION TITLE: Demate Tug from Kick Stage	
FUNCTION OBJECTIVE:  Demate engineering model Tug mechanically from Kick Stage.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>4</u> MIN <u>2</u>	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>  _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>6</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH <u>2</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____ _____ _____	
		HAZARDOUS YES <u>x</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>A-001, H-014</u> _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input checked="" type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES <u>5</u> MANHOURS <u>30</u>	
		NEW <u>3</u> <u>9</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Attach overhead crane to stage; position pin pullers to the retracted position. Lift Kick Stage from Tug and place in Kick Stage adapter.			
REMARKS:  Hazardous due to hoisting operations. * Engineering model only			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 7.13*		FUNCTION TITLE: Separate Tug from Adapter	
FUNCTION OBJECTIVE: Remove deployment adapter from Tug for ship to WTR.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>4</u> MIN <u>2</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>5</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH _____ MECH/STRU/TH TECH <u>2</u> AVIONICS TECH _____ SAFETY ENGINEER <u>1</u> QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____ _____ _____	
		HAZARDOUS. YES <u>x</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> (SPECIFY) <u>H-007</u> _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
		PROCEDURES PAGES <u>5</u> MANHOURS <u>30</u>	
		NEW <u>3</u> CHANGE <u>9</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Position deployment adapter dolly under adapter, attach adapter support arms to adapter at the adapter-orbiter interface attachment fillings. Mechanically demate adapter from Tug intertank skirt and lower dolly support arms. Move adapter for inspection and cleaning.			
REMARKS: Hazardous due to movement * Engineering model only			
COMMODITIES/CONSUMABLES REQUIRED:			



## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: <b>7.14*</b>		FUNCTION TITLE: <b>Remove Ship-Loose Equipment</b>	
FUNCTION OBJECTIVE:  <b>Prepare EM for ship to WTR</b>			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>17</u> MIN <u>10</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>8</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>2</u> PROPULSION TECH <u>1</u> MECH/STRU/TH TECH <u>2</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>2</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES _____ NO <u>x</u>	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES _____ MANHOURS _____	
OPERATIONS:  <b>Electrically and mechanically disconnect all ship-loose components from the model</b>			
REMARKS:  <b>* Engineering model only</b>			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: 7.15*		FUNCTION TITLE: Visual external damage inspection	
FUNCTION OBJECTIVE:  Visual inspection of designated areas in preparation for shipment to WTR			
SITE LOCATION ETR <input type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>12</u> MIN <u>2</u>	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input checked="" type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER <u>7</u> TEST CONDUCTOR _____ TEST ENGINEERS <u>1</u> PROPULSION TECH <u>2</u> MECH/STRU/TH TECH <u>2</u> AVIONICS TECH <u>1</u> SAFETY ENGINEER _____ QUAL CONT. TECH <u>1</u> TECHNICAL SUPPORT _____	
		HAZARDOUS YES _____ NO <u>x</u>	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
		PROCEDURES PAGES <u>4</u> MANHOURS <u>24</u>	
		NEW <u>2</u> CHANGE <u>6</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Perform a visual damage inspection of exterior surfaces as follows: Deployment adapter, forward skirt, LH <sub>2</sub> main shell and intertank skirt.			
REMARKS:  * Engineering model only			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: Ref 1		FUNCTION TITLE: Shuttle Flight Operations	
FUNCTION OBJECTIVE:  Mission Operations			
SITE LOCATION ETR <input type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX _____ MIN _____	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		HAZARDOUS YES _____ NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____	
		PROCEDURES NEW CHANGE	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input type="checkbox"/>	
		PAGES _____ MANHOURS _____	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Reference Only			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

[illegible]

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: Ref 3		FUNCTION TITLE: Safety Verification and Crew Exchange	
FUNCTION OBJECTIVE:  Verify Payload and Orbiter Systems are in a safe condition.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>1.5</u> MIN <u>1.0</u>	
AREA LOCATION OLF <input checked="" type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER _____ TEST CONDUCTOR _____ TEST ENGINEERS _____ PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____ _____	
		HAZARDOUS YES _____ NO <u>x</u> _____	
		GROUND SUPPORT EQUIPMENT N/A LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____	
TUG INTERFACE: ORBITER <input checked="" type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
SOFTWARE REQUIREMENTS: N/A LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES _____ MANHOURS _____	
OPERATIONS:  Orbiter flight crew makes a final check and monitors/controls to ensure all Payload Caution and Warning parameters are within limits prior to egress. Crew verifies propellant tank integrity, ordnance circuits electrically safe, and pressures/hazardous fluids at safe level. Flight crew also initiates and verifies the transfer of control of Tug functions to Ground Control.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED: N/A			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: Ref 4		FUNCTION TITLE: Tow Orbiter to OPF	
FUNCTION OBJECTIVE:  Move Orbiter from landing field to Orbiter Processing Facility (OPF)			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX 2.0 MIN 1.0	
AREA LOCATION OLF <input type="checkbox"/> OPF <input checked="" type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) N/A TOTAL MANPOWER _____ TEST CONDUCTOR _____ TEST ENGINEERS _____ PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		HAZARDOUS YES <input checked="" type="checkbox"/> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____ _____	
TUG INTERFACE: ORBITER <input checked="" type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
		PROCEDURES PAGES _____ MANHOURS _____	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Tug Ground Control monitors/controls Tug tank pressures during post landing temperature variations. During this period, also verify post landing pressure integrity of all tanks in the gross terms available with flight instrumentation.			
REMARKS:  Non-Tug Function			
COMMODITIES/CONSUMABLES REQUIRED: N/A			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: Ref 5		FUNCTION TITLE: Unload Orbiter Propellant, Fuel Cells, Vent Pressure and Safe Systems	
FUNCTION OBJECTIVE: Safe Orbiter			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>16</u> MIN <u>8.5</u>	
HAZARDOUS YES <u>x</u> NO <u>      </u>			
AREA LOCATION OLF <input type="checkbox"/> OPF <input checked="" type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>   		PERSONNEL (HEADCOUNT) N/A TOTAL MANPOWER <u>      </u> TEST CONDUCTOR <u>      </u> TEST ENGINEERS <u>      </u> PROPULSION TECH <u>      </u> MECH/STRU/TH TECH <u>      </u> AVIONICS TECH <u>      </u> SAFETY ENGINEER <u>      </u> QUAL CONT. TECH <u>      </u> TECHNICAL SUPPORT <u>      </u>	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY)   			
TUG INTERFACE: ORBITER <input checked="" type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
PROCEDURES		NEW PAGES <u>      </u> MANHOURS <u>      </u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		CHANGE   	
OPERATIONS:  Establish Payload Bay purge and hazardous vapor detection. If Tug hydrogen tanks require venting, the Orbiter H <sub>2</sub> vent for Tug will be connected to a burn stack.			
REMARKS: Vent lines are attached to Tug propellant systems via the Orbiter for venting and purging if required.			
COMMODITIES/CONSUMABLES REQUIRED:  N/A			

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FUNCTION NO: Ref 6		FUNCTION TITLE: Install GSE, Open Payload Bay Doors	
FUNCTION OBJECTIVE:			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX 10 MIN 5	
AREA LOCATION OLF <input checked="" type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/>		PERSONNEL (HEADCOUNT) TOTAL MANPOWER _____ TEST CONDUCTOR _____ TEST ENGINEERS _____ PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		HAZARDOUS YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____	
TUG INTERFACE: ORBITER <input checked="" type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES _____ MANHOURS _____	
OPERATIONS:  Vent pressure systems to sole level if required			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			



# TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: Ref. 7		FUNCTION TITLE: Flight Abort	
FUNCTION OBJECTIVE:			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX _____ MIN _____	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER _____ TEST CONDUCTOR _____ TEST ENGINEERS _____ PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____ _____	
		HAZARDOUS YES _____ NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES _____ MANHOURS _____	
OPERATIONS:  Reference Only.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: Ref. 8		FUNCTION TITLE: Orbiter Landing at SHA	
FUNCTION OBJECTIVE: Land Safely			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX _____ MIN _____	
		HAZARDOUS YES _____ NO _____	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER _____ TEST CONDUCTOR _____ TEST ENGINEERS _____ PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____ _____ _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input type="checkbox"/>	
		PROCEDURES PAGES _____ MANHOURS _____	
		NEW CHANGE	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Reference Only.			
REMARKS: Non-Tug Function			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: Ref. 9		FUNCTION TITLE: Safe Systems and Connect Ground Cooling	
FUNCTION OBJECTIVE:  Electrically Safe Tug Systems			
SITE LOCATION ETH <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>1.5</u> MIN <u>.5</u>	
AREA LOCATION OLF <input checked="" type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER _____ TEST CONDUCTOR _____ TEST ENGINEERS _____ PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____ <u>FLIGHT CREW</u>	
		HAZARDOUS YES <u>X</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____	
TUG INTERFACE: ORBITER <input checked="" type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
		PROCEDURES PAGES _____ MANHOURS _____	
		NEW CHANGE	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Verify all Tug Systems electrically safed.			
REMARKS:  Hazardous because of propellant in bay. Non-Tug ground operations functions.			
COMMODITIES/CONSUMABLES REQUIRED:  N/A			

# TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: Ref 10		FUNCTION TITLE: Delivery to Shuttle Airfield	
FUNCTION OBJECTIVE: Transport Tug from manufacturing facility to KSC.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX _____ MIN _____	
AREA LOCATION OLF <input checked="" type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER _____ TEST CONDUCTOR _____ TEST ENGINEERS _____ PROPULSION TECH _____ MECH/ST RU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		HAZARDOUS YES _____ NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input type="checkbox"/>	
		PROCEDURES PAGES _____ MANHOURS _____	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS: Not Ground Operations Function			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: Ref 11		FUNCTION TITLE: Connect S/C Carry Near GSE	
FUNCTION OBJECTIVE:  Connect S/C GSE as required to support systems verification.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX <u>5</u> MIN <u>2</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input checked="" type="checkbox"/> SPF <input checked="" type="checkbox"/> PCR <input checked="" type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER _____ TEST CONDUCTOR _____ TEST ENGINEERS _____ PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		HAZARDOUS YES <u>x</u> NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/>	
		PROCEDURES N/A NEW CHANGE PAGES _____ MANHOURS _____	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Connect/install spacecraft GSE as required to support Tug/kick stage interface verification.  Non-Tug function.			
REMARKS: Monitor function only for Tug ground operations. Hazardous due to ordnance and S/C propellants.			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: Ref 12		FUNCTION TITLE: Mate Shuttle to Pad, Shuttle Servicing Preps.	
FUNCTION OBJECTIVE:  Install shuttle on pad			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX - MIN 6.5	HAZARDOUS YES _____ NO _____
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input checked="" type="checkbox"/> ORB <input type="checkbox"/> _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER _____ TEST CONDUCTOR _____ TEST ENGINEERS _____ PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____ _____ _____ _____ _____ _____
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input type="checkbox"/>	PROCEDURES NEW CHANGE PAGES _____ MANHOURS _____
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Non-Tug function			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: Ref 13		FUNCTION TITLE: Launch Readiness Verification	
FUNCTION OBJECTIVE: Verify Shuttle ready for servicing and pre-launch operations.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX _____ MIN <u>3.0</u>	
HAZARDOUS YES _____ NO _____			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input checked="" type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER _____ TEST CONDUCTOR _____ TEST ENGINEERS _____ PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____		PROCEDURES NEW CHANGE PAGES _____ MANHOURS _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Non-Tug function			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

# TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: Ref 14		FUNCTION TITLE: Purge and Sample Facility LO <sub>2</sub> and LH <sub>2</sub> System	
FUNCTION OBJECTIVE:  Verify cleanliness of systems			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX _____ MIN <u>2.0</u>	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		HAZARDOUS YES _____ NO _____	
PERSONNEL (HEADCOUNT) TOTAL MANPOWER _____ TEST CONDUCTOR _____ TEST ENGINEERS _____ PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input type="checkbox"/>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>		PROCEDURES PAGES _____ MANHOURS _____	
OPERATIONS:  Non-Tug function			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			



## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: Ref 15		FUNCTION TITLE: Final S/C Service and Flight Preps.	
FUNCTION OBJECTIVE:  Prep. S/C for Flight			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX _____ MIN _____	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input checked="" type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER _____ TEST CONDUCTOR _____ TEST ENGINEERS _____ PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		HAZARDOUS YES _____ NO _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
		PROCEDURES PAGES _____ MANHOURS _____	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Final S/C servicing, if required, for RTG's, biological payloads, etc.			
REMARKS:  Non-Tug function			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: Ref 16		FUNCTION TITLE: Cabin Closeout	
FUNCTION OBJECTIVE:  Final Orbiter Cabin Set-Up and Prep. for Launch			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX _____ MIN. 1.5	
HAZARDOUS YES _____ NO _____			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input checked="" type="checkbox"/> ORB <input type="checkbox"/> _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER _____ TEST CONDUCTOR _____ TEST ENGINEERS _____ PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input type="checkbox"/>	
PROCEDURES PAGES _____ MANHOURS _____		NEW CHANGE	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Non-Tug Function			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: Ref 17		FUNCTION TITLE: Clear Pad and Shuttle Service	
FUNCTION OBJECTIVE: Clear pad of non-essential personnel and service ECLSS, condition ET, helium service shuttle and service orbiter fuel cells.			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX _____ MIN <u>4.5</u>	
HAZARDOUS YES _____ NO _____			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input checked="" type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER _____ TEST CONDUCTOR _____ TEST ENGINEERS _____ PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____			
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input type="checkbox"/>	
PROCEDURES		NEW	CHANGE
PAGES _____			
MANHOURS _____			
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Non-Tug function			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: Ref 18		FUNCTION TITLE: Orbiter Hypergolic Servicing	
FUNCTION OBJECTIVE:  Load orbiter hypergolic			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX _____ MIN <u>6.0</u>	
		HAZARDOUS YES _____ NO _____	
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input checked="" type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER _____ TEST CONDUCTOR _____ TEST ENGINEERS _____ PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input type="checkbox"/>	
		PROCEDURES PAGES _____ MANHOURS _____	
		NEW CHANGE	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Non-Tug Function			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: Ref 19		FUNCTION TITLE: Open Pad and Servicing Disconnect.	
FUNCTION OBJECTIVE:  Disconnect Shuttle Servicing Lines			
SITE LOCATION ETR <input checked="" type="checkbox"/> WTR <input checked="" type="checkbox"/>		TIME TO COMPLETE (HRS) MAX _____ MIN <u>1.5</u>	
HAZARDOUS YES <u>x</u> NO _____			
AREA LOCATION OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input checked="" type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER _____ TEST CONDUCTOR _____ TEST ENGINEERS _____ PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____ _____			
TUG INTERFACE: ORBITER <input checked="" type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/>	
PROCEDURES		NEW PAGES <u>2</u>	CHANGE <u>1</u>
MANHOURS <u>12</u>		<u>3</u>	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Disconnect Tug Helium Supply from Orbiter Interface.			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG FUNCTION DESCRIPTION DATA SHEET

FUNCTION NO: Ref 20		FUNCTION TITLE: Close Orbiter Bay Doors, Retract PCR and Clear Pad	
FUNCTION OBJECTIVE:  Final Preps for Shuttle Launch			
SITE LOCATION ETR <input type="checkbox"/> WTR <input type="checkbox"/>		TIME TO COMPLETE (HRS) MAX _____ MIN <u>1.5</u>	
		HAZARDOUS YES _____ NO <u>1</u>	
AREA LOCATION  OLF <input type="checkbox"/> OPF <input type="checkbox"/> TPF <input type="checkbox"/> SPF <input type="checkbox"/> PCR <input type="checkbox"/> ORB <input type="checkbox"/> _____ _____ _____		PERSONNEL (HEADCOUNT) TOTAL MANPOWER _____ TEST CONDUCTOR _____ TEST ENGINEERS _____ PROPULSION TECH _____ MECH/STRU/TH TECH _____ AVIONICS TECH _____ SAFETY ENGINEER _____ QUAL CONT. TECH _____ TECHNICAL SUPPORT _____	
		GROUND SUPPORT EQUIPMENT LPS <input type="checkbox"/> OTHER <input type="checkbox"/> (SPECIFY) _____ _____ _____ _____ _____	
TUG INTERFACE: ORBITER <input type="checkbox"/> FACILITY <input type="checkbox"/> SPACECRAFT <input type="checkbox"/> SOFTWARE <input type="checkbox"/>		TUG ORIENTATION: HORIZONTAL <input type="checkbox"/> VERTICAL <input type="checkbox"/>	
		PROCEDURES PAGES _____ MANHOURS _____	
		NEW CHANGE	
SOFTWARE REQUIREMENTS: LPS <input type="checkbox"/> ORB ON-BOARD COMP <input type="checkbox"/> TUG ON-BOARD COMP <input type="checkbox"/> GROUND CONTROL STATION <input type="checkbox"/> OTHER <input type="checkbox"/>			
OPERATIONS:  Non-Tug Function			
REMARKS:			
COMMODITIES/CONSUMABLES REQUIRED:			

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

A Tug GSE Requirements Specification Sheet is prepared for each item of GSE required to perform the ground checkout function<sup>\*</sup>. These sheets, catalogued by GSE unit number, provide the following summary information:

Name:	The GSE article name
Item No.:	An alpha-numeric identification system of identifying and cataloguing the GSE in four categories: <ol style="list-style-type: none"><li>1. A-XXX Avionics GSE</li><li>2. H-XXX Handling Access and Transportation GSE</li><li>3. P-XXX Propulsion and Mechanical GSE</li><li>4. S-XXX Structural GSE</li></ol>
Requirement Summary:	Summary and identification of specific support requirements requiring this GSE item.
Item Description:	A narrative description of the GSE item and its function in support of the Tug Functional Flow Diagram.
Dimensions:	Physical size of the unit.
Power:	Power and power characteristics required from facility interface to support GSE unit.
Weight (lbs):	Physical weight of unit.
Fluid Requirements:	Type ( $H_2$ , $N_2$ , $H_2O$ ) and amount (pressure, flow rate) of fluids (liquid and gas) from facility interface required to support unit operation.
Article or Assembly Supported:	Identification of articles, Tug, kick stage, adapter, etc., that a workstand or test fixture must be able to support.

<sup>\*</sup>Defined in the Tug Function Description Data Sheets in Appendix A.

Vehicle  
Interface: Description of physical interface between flight  
article and GSE unit.

Facility  
Interface: Description of physical interface between GSE and  
the facility where it is located.

Other  
Interfacing GSE: Identification of GSE units that interface with  
this particular GSE item.

Mobility  
Requirements: Identification of any mobility/portability require-  
ments for particular unit.

Operational Mode: Identification of the normal modes of operation of  
unit, i.e., local, remote or both, with any clarifying  
comments.

Software  
Requirements: Definition of GSE software requirements (programs)  
necessary for GSE unit to accomplish its operational  
function.

Equipment Source: Identifies possible source of GSE item, i.e., new,  
existing, modified, commercial, with clarifying  
remarks.

Equipment  
Allocation: Provide a cross reference of GSE utilization to  
functional flow block number<sup>\*</sup> of GSE item number.  
Additionally, the number of units required to support  
Tug activity at each launch site is identified.

\*Reference: subplan A, Volume II, Part I.



# TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Electrical Power Supply</u>		ITEM NO. <u>A-001</u>	
REQUIREMENT SUMMARY <u>Provide voltage and current to operate the Tug primary and secondary power systems during test and/or repair operations.</u>			
ITEM DESCRIPTION <u>The Tug Electrical Power Supply will provide the proper voltage regulation, circuit isolation, and overload protection for the Tug flight hardware.</u>			
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H <u>  </u> POWER <u>110/220V</u> <u>60</u> Hz <u>1</u> <u>0</u> KW			
WEIGHT (LBS) <u>  </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u>  </u> QUAN. <u>  </u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug Flight Systems</u>			
VEHICLE INTERFACE <u>  </u>			
FACILITY INTERFACE <u>110/220 Vac Commercial Power</u>			
OTHER INTERFACING GSE <u>  </u>			
MOBILITY REQUIREMENTS <u>  </u>			
OPERATIONAL MODE: LOCAL <input checked="" type="checkbox"/> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			
REMARKS		QUANTITY	
		WTR	ETR
TOTAL REQUIRED		2	3

TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Electrical Power Test Set</u>		ITEM NO. <u>A-002</u>	
REQUIREMENT SUMMARY <u>Provide power source, circuit isolation, dummy loads, current switching, and overload protection.</u>			
ITEM DESCRIPTION <u>The Tug electrical power test set provides external stimuli, measurement, and recording capabilities to test components and subassemblies of the Tug electrical power system to isolate out of spec power tolerances.</u>			
DIMENSIONS (FT) <u>    </u> L <u>    </u> W <u>    </u> H		POWER <u>110</u> V <u>60</u> Hz <u>1</u> <u>0</u> KW	
WEIGHT (LBS) <u>                    </u>		FLUID REQUIREMENTS <u>N/A</u> PSIG <u>    </u> QUAN. <u>    </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>                                    </u>			
VEHICLE INTERFACE <u>                                    </u>			
FACILITY INTERFACE <u>                                    </u>			
OTHER INTERFACING GSE <u>External recording or monitoring equipment.</u>			
MOBILITY REQUIREMENTS <u>                                    </u>			
OPERATIONAL MODE: LOCAL <u>x</u> REMOTE <u>    </u> BOTH <u>    </u> DETAILS <u>    </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			WTR ETR
REMARKS		<u>2.11, 4.17, 4.39</u>	<u>2</u>
		TOTAL REQUIRED	<u>2</u>

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Electrical Load Banks</u>		ITEM NO. <u>A-003</u>	
REQUIREMENT SUMMARY <u>Simulate Tug electrical loads during power distribution tests.</u>			
ITEM DESCRIPTION <u>The Tug electrical load banks consist of fixed and variable impedance used, in conjunction with the electrical power test set, to simulate electrical loads during power distribution tests.</u>			
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H <u>  </u> POWER <u>N/A</u> V <u>  </u> Hz <u>  </u> <u>0</u> KW			
WEIGHT (LBS) <u>  </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u>  </u> QUAN. <u>  </u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>  </u>			
VEHICLE INTERFACE <u>  </u>			
FACILITY INTERFACE <u>  </u>			
OTHER INTERFACING GSE <u>Electrical Power Test Set.</u>			
MOBILITY REQUIREMENTS <u>  </u>			
OPERATIONAL MODE: LOCAL <u>x</u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/>	EXISTING <input checked="" type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR
REMARKS		2.11, 4.17, 4.19, 4.39	2
		TOTAL REQUIRED	2

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Battery Test Set</u>		ITEM NO. <u>A-004</u>	
REQUIREMENT SUMMARY <u>Provide the capability to verify the condition of the battery electrolyte and to determine the cell/battery voltages under load and no-load conditions.</u>			
ITEM DESCRIPTION <u>The Tug Battery Test Set provides the equipment required to checkout battery activation, cell/battery voltage with or without loads under static or charging conditions. The Tug Battery Test Set provides heater power measure, heater current, and battery temperature. Cable set included.</u>			
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H		POWER <u>110/220V</u> 60 Hz <u>1</u> <u>0</u> KW	
WEIGHT (LBS) <u>  </u>		FLUID REQUIREMENTS <u>N/A</u> PSIG <u>  </u> QUAN. <u>  </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug Batteries</u>			
VEHICLE INTERFACE <u>  </u>			
FACILITY INTERFACE <u>  </u>			
OTHER INTERFACING GSE <u>  </u>			
MOBILITY REQUIREMENTS <u>  </u>			
OPERATIONAL MODE: LOCAL <input checked="" type="checkbox"/> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>  </u>			

EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR
REMARKS			
TOTAL REQUIRED			2

# TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Battery Charger</u>		ITEM NO. <u>A-005</u>		
REQUIREMENT SUMMARY <u>The battery charger is required to service Tug batteries after each cycle.</u>				
ITEM DESCRIPTION <u>The battery charger shall provide the capability to charge a (TBD) load at (TBD) volts at a constant rate until batteries are fully charged and then provide a trickle charge to maintain maximum charge. Battery cable set included with battery charger.</u>				
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H <u>  </u> POWER <u>110/220V</u> <u>60</u> Hz <u>1</u> <u>0</u> KW				
WEIGHT (LBS) <u>  </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u>N/A</u> QUAN. <u>N/A</u>				
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug Batteries in or out of Tug</u>				
VEHICLE INTERFACE <u>Orbiter Interface Panel</u>				
FACILITY INTERFACE <u>110/220 Vac commercial power</u>				
OTHER INTERFACING GSE <u>  </u>				
MOBILITY REQUIREMENTS <u>  </u>				
OPERATIONAL MODE: LOCAL <u>X</u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>				
SOFTWARE REQUIREMENTS <u>  </u>				
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:		
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY	
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR	ETR
REMARKS		5.7		
TOTAL REQUIRED				

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Communications Test &amp; Checkout Equipment</u>		ITEM NO. <u>A-006</u>	
REQUIREMENT SUMMARY <u>Verify the system/subsystem operation of the communications, system and its capability to receive, transmit, and respond to external stimuli on command.</u>			
ITEM DESCRIPTION <u>(TBD)</u>			
DIMENSIONS (FT) <u>    </u> L <u>    </u> W <u>    </u> H		POWER <u>    </u> V <u>    </u> Hz <u>    </u> $\theta$ <u>    </u> KW	
WEIGHT (LBS) <u>    </u>		FLUID REQUIREMENTS <u>    </u> PSIG <u>    </u> QUAN. <u>    </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>    </u>			
VEHICLE INTERFACE <u>    </u>			
FACILITY INTERFACE <u>    </u>			
OTHER INTERFACING GSE <u>    </u>			
MOBILITY REQUIREMENTS <u>    </u>			
OPERATIONAL MODE: LOCAL <u>    </u> REMOTE <u>    </u> BOTH <u>    </u> DETAILS <u>    </u>			
SOFTWARE REQUIREMENTS <u>    </u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR
REMARKS		2.11, 4.44	1
		TOTAL REQUIRED	1

# TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Guidance &amp; Navigation Test &amp; Checkout Equipment</u> ITEM NO. <u>A-007</u>			
REQUIREMENT SUMMARY <u>Erect and align IMUs, relate enter angles and drifts of the redundant units; perform on-pad short term navigation; validate navigation software and perform sequencing run.</u>			
ITEM DESCRIPTION <u>Part of LPS system or other automatic ground computer controlled system communicating and controlling A/B navigation and computer system.</u>			
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H <u>  </u>		POWER <u>  </u> V <u>  </u> Hz <u>  </u> $\theta$ <u>  </u> KW	
WEIGHT (LBS) <u>  </u>		FLUID REQUIREMENTS <u>  </u> PSIG <u>  </u> QUAN. <u>  </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>  </u>			
VEHICLE INTERFACE <u>  </u>			
FACILITY INTERFACE <u>  </u>			
OTHER INTERFACING GSE <u>  </u>			
MOBILITY REQUIREMENTS <u>  </u>			
OPERATIONAL MODE: LOCAL <u>  </u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>  </u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			WTR ETR
REMARKS		2.11, 4.43	1
		TOTAL REQUIRED	1

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Control and Data Acquisition Console</u>		ITEM NO. <u>A-008</u>		
REQUIREMENT SUMMARY <u>This console is to be used by the test conductor. The displays will present real-time data and provide for call-back of prior results. The controls shall be able to activate, sequence, and terminate the testing as necessary. The control encompasses the system under test and is the origin of the pre-programmed test sequences. The interface shall be with the launch processing system. The console will include a count clock system to provide count time and real time. Displays will include digital and video presentations. Switching and other controls shall provide convenient, accurate activation, sequencing, and termination of the test operation. The console will house the necessary communications between the LPS and the test area under control.</u>				
DIMENSIONS (FT) <u>3</u> L <u>3</u> W <u>5</u> H POWER <u>120</u> V <u>60</u> Hz <u>1</u> <u>0</u> KW WEIGHT (LBS) <u>600</u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u>      </u> QUAN. <u>      </u>				
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug systems</u>				
VEHICLE INTERFACE <u>      </u>				
FACILITY INTERFACE <u>      </u>				
OTHER INTER-FACING GSE <u>      </u>				
MOBILITY REQUIREMENTS <u>None</u>				
OPERATIONAL MODE: LOCAL <input checked="" type="checkbox"/> REMOTE <input type="checkbox"/> BOTH <input type="checkbox"/> DETAILS <input type="checkbox"/>				
SOFTWARE REQUIREMENTS <u>      </u>				
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:		
NEW <input checked="" type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY	
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR	ETR
REMARKS		1.6, 2.11, 4.19, 4.21, 4.26,		
		4.27, 4.28, 4.40, 4.42, 4.43,		
		4.44, 4.46, 4.47, 5.2, 5.4		
			1	1
		TOTAL REQUIRED	1	1



# TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Memory Load &amp; Verify Unit</u>		ITEM NO. <u>A-009</u>	
REQUIREMENT SUMMARY <u>This unit will be used during pre-launch Tug activities to load and verify the Tug Flight Program. It will also be used during initial memory loads. It should have the capability to load and verify the memory from punched tape. A buffering unit should be included to provide the necessary isolation and buffering for interface compatibility.</u>			
DIMENSIONS (FT) <u>    </u> L <u>    </u> W <u>    </u> H		POWER <u>120</u> V <u>60</u> Hz <u>1</u> <u>0</u> KW	
WEIGHT (LBS) <u>                    </u>		FLUID REQUIREMENTS <u>N/A</u> PSIG <u>    </u> QUAN. <u>    </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>                                    </u>			
VEHICLE INTERFACE <u>                                    </u>			
FACILITY INTERFACE <u>                                    </u>			
OTHER INTERFACING GSE <u>                                    </u>			
MOBILITY REQUIREMENTS <u>                                    </u>			
OPERATIONAL MODE: LOCAL <u>    </u> REMOTE <u>    </u> BOTH <u>    </u> DETAILS <u>    </u>			
SOFTWARE REQUIREMENTS <u>                                    </u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			
REMARKS		QUANTITY	
		WTR ETR	
		2.11, 4.20, 4.27, 4.43, 5.2	
		1 2	
TOTAL REQUIRED		1 2	

# TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Electronics Calibration Equipment</u>		ITEM NO. <u>A-010</u>	
REQUIREMENT SUMMARY <u>The electronics calibration equipment is used to calibrate the communications and guidance and navigation electronics following maintenance and during checkout.</u>			
ITEM DESCRIPTION _____			
DIMENSIONS (FT) _____ L _____ W _____ H _____		POWER _____ V _____ Hz _____ $\theta$ _____ KW	
WEIGHT (LBS) _____		FLUID REQUIREMENTS _____ PSIG _____ QUAN. _____	
ARTICLE OR ASSEMBLY SUPPORTED _____			
VEHICLE INTERFACE _____			
FACILITY INTERFACE _____			
OTHER INTERFACING GSE _____			
MOBILITY REQUIREMENTS _____			
OPERATIONAL MODE: LOCAL _____ REMOTE _____ BOTH _____ DETAILS _____			
SOFTWARE REQUIREMENTS _____			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			
REMARKS		2.11, 4.21	QUANTITY
			WTR ETR
			1
		TOTAL REQUIRED	1

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Orbiter Cable Simulator</u>		ITEM NO. <u>A-011</u>	
REQUIREMENT SUMMARY <u>Simulate Orbiter cabling from Tug/Orbiter Interface to MSS/PSS Payload console.</u>			
ITEM DESCRIPTION <u>The simulator contains cables and connectors necessary to connect the Payload Console to the Tug systems while simulating the impedance characteristics of the Orbiter cable.</u>			
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H		POWER <u>N/A</u> V <u>  </u> Hz <u>  </u> $\theta$ <u>  </u> KW	
WEIGHT (LBS) <u>  </u>		FLUID REQUIREMENTS <u>N/A</u> PSIG <u>  </u> QUAN. <u>  </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>Payload Console</u>			
VEHICLE INTERFACE <u>Tug/Orbiter electrical umbilical</u>			
FACILITY INTERFACE <u>N/A</u>			
OTHER INTERFACING GSE <u>None</u>			
MOBILITY REQUIREMENTS <u>N/A</u>			
OPERATIONAL MODE: LOCAL <u>X</u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>		QUANTITY	
REMARKS		WTR	ETR
		1	2
TOTAL REQUIRED		1	2

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Umbilical Simulator</u>		ITEM NO. <u>A-012</u>		
REQUIREMENT SUMMARY <u>Physical and functional testing of the Tug/Orbiter umbilicals.</u>				
ITEM DESCRIPTION <u>The simulator consists of the Orbiter flight type carrier, electrical connectors and fluid line disconnects.</u>				
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H		POWER <u>N/A</u> V <u>  </u> Hz <u>0</u> KW		
WEIGHT (LBS) <u>  </u>		FLUID REQUIREMENTS <u>GN<sub>2</sub></u> PSIG <u>  </u> QUAN. <u>  </u>		
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug Umbilical</u>				
VEHICLE INTERFACE <u>Tug/Orbiter umbilical I/F</u>				
FACILITY INTERFACE <u>N/A</u>				
OTHER INTERFACING GSE <u>Pressurization Control Set</u>				
MOBILITY REQUIREMENTS <u>Mobile</u>				
OPERATIONAL MODE: LOCAL <u>X</u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>				
SOFTWARE REQUIREMENTS <u>N/A</u>				
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:		
NEW <input checked="" type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY	
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR	ETR
REMARKS		<u>5.4</u>	<u>1</u>	<u>2</u>
TOTAL REQUIRED			<u>1</u>	<u>2</u>

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Star Sensor Stimulator</u>		ITEM NO. <u>A-013</u>	
REQUIREMENT SUMMARY <u>Functional checkout of Star Tracker</u>			
ITEM DESCRIPTION <u>Portable unit that mounts directly on the Tug star tracker.</u>			
<u>It will provide a simulated star pattern.</u>			
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H <u>  </u> POWER <u>120</u> V <u>60</u> Hz <u>1</u> <u>0</u> KW			
WEIGHT (LBS) <u>  </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u>  </u> QUAN. <u>  </u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug Star Tracker</u>			
VEHICLE INTERFACE <u>Star Tracker</u>			
FACILITY INTERFACE <u>N/A</u>			
OTHER INTERFACING GSE <u>LPS</u>			
MOBILITY REQUIREMENTS <u>Portable</u>			
OPERATIONAL MODE: LOCAL <u>X</u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>LPS Star Tracker C/O Program</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR
REMARKS		4.21, 4.40, 4.43	1
		TOTAL REQUIRED	1

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Tug/Spacecraft Simulator</u>		ITEM NO. <u>A-014</u>	
REQUIREMENT SUMMARY <u>Checkout Deployment Adapter/Tug Interface (capture and release under load).</u>			
ITEM DESCRIPTION <u>The Tug/Spacecraft Simulator will provide the interface conditions necessary to verify Tug capture and release under simulated load conditions.</u>			
DIMENSIONS (FT) <u>    </u> L <u>    </u> W <u>    </u> H		POWER <u>N/A</u> V <u>    </u> Hz <u>0</u> KW	
WEIGHT (LBS) <u>    </u>		FLUID REQUIREMENTS <u>N/A</u> PSIG <u>    </u> QUAN. <u>    </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>Deployment Adapter</u>			
VEHICLE INTERFACE <u>Deployment Adapter/Tug I/F Ring</u>			
FACILITY INTERFACE <u>N/A</u>			
OTHER INTERFACING GSE <u>    </u>			
MOBILITY REQUIREMENTS <u>    </u>			
OPERATIONAL MODE: LOCAL <u>X</u> REMOTE <u>    </u> BOTH <u>    </u> DETAILS <u>    </u>			
SOFTWARE REQUIREMENTS <u>    </u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input checked="" type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>		QUANTITY	
REMARKS		WTR	ETR
			2
TOTAL REQUIRED			2

# TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Fuel Cell Dummy Load Unit</u>		ITEM NO. <u>A-015</u>	
REQUIREMENT SUMMARY <u>Provide variable resistance loads. Load control logic, current and voltage sensors, for fuel cell functional testing</u>			
ITEM DESCRIPTION <u>Connects to the Tug fuel cell and simulates Tug electrical loads during fuel cell functional testing.</u>			
DIMENSIONS (FT) <u>2</u> L <u>2</u> W <u>1.5</u> H		POWER <u>120</u> V <u>60</u> Hz <u>1</u> <u>0</u> KW	
WEIGHT (LBS) <u>200</u>		FLUID REQUIREMENTS <u>N/A</u> PSIG <u> </u> QUAN. <u> </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug Fuel Cell</u>			
VEHICLE INTERFACE <u> </u>			
FACILITY INTERFACE <u> </u>			
OTHER INTERFACING GSE <u>LPS interfaces for control and data transfer during functional tests of the fuel cell.</u>			
MOBILITY REQUIREMENTS <u>None</u>			
OPERATIONAL MODE: LOCAL <u> </u> REMOTE <u> </u> BOTH <u>x</u> DETAILS <u> </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>		QUANTITY	
REMARKS		WTR	ETR
<u>Used for fuel cell maintenance and refurbishment</u>			
TOTAL REQUIRED		2	

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Ordnance Event Verification Cables</u>		ITEM NO. <u>A-016</u>	
REQUIREMENT SUMMARY <u>To provide event sequencing of the Tug/Kick Stage when ordnance items are installed.</u>			
ITEM DESCRIPTION <u>Wiring harness to provide connection and run-arounds of ordnance devices. The cables will have the capability to monitor and record event occurrence without stopping the sequence timing.</u>			
DIMENSIONS (FT) _____ L _____ W _____ H _____ POWER <u>120</u> V <u>60</u> Hz <u>1</u> <u>Ø</u> KW			
WEIGHT (LBS) _____ FLUID REQUIREMENTS <u>N/A</u> PSIG _____ QUAN. _____			
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug/Kick Stage Ordnance</u>			
VEHICLE INTERFACE _____			
FACILITY INTERFACE _____			
OTHER INTERFACING GSE _____			
MOBILITY REQUIREMENTS _____			
OPERATIONAL MODE: LOCAL _____ REMOTE _____ BOTH <u>x</u> DETAILS _____			
SOFTWARE REQUIREMENTS _____			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			WTR ETR
REMARKS		<u>4.26, 4.28</u>	<u>1 1</u>
TOTAL REQUIRED		<u>1</u>	<u>1</u>



## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Latch Mechanism Test Set</u>		ITEM NO. <u>A-017</u>	
REQUIREMENT SUMMARY <u>To provide the capability to energize the Tug/Kick Stage mating pin pullers and Tug/Adapter separation latches.</u>			
ITEM DESCRIPTION <u>The latch mechanism test set will be used to energize the spacecraft interfaces for mate and demate operations to support simulated Tug activities. The test set will be used to verify the functional integrity of the adapter to Tug latching mechanism.</u>			
DIMENSIONS (FT) <u>    </u> L <u>    </u> W <u>    </u> H    POWER <u>120</u> V <u>60</u> Hz <u>1</u> <u>0</u> KW			
WEIGHT (LBS) <u>    </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u>    </u> QUAN. <u>    </u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug spacecraft adapter</u>			
VEHICLE INTERFACE <u>    </u>			
FACILITY INTERFACE <u>    </u>			
OTHER INTERFACING GSE <u>    </u>			
MOBILITY REQUIREMENTS <u>    </u>			
OPERATIONAL MODE:    LOCAL <u>x</u> REMOTE <u>    </u> BOTH <u>    </u> DETAILS <u>    </u>			
SOFTWARE REQUIREMENTS <u>    </u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input checked="" type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR
REMARKS		4.16	1
		TOTAL REQUIRED	1

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Hardware Interface Module (HIM)</u>		ITEM NO. <u>A-018</u>	
REQUIREMENT SUMMARY <u>Interfaces the LPS to GSE; provides stimuli and monitoring capabilities.</u>			
ITEM DESCRIPTION <u>The HIM is a single rack of electronic equipment. It uses a modular concept to accommodate varying user requirements by using a group of standard and nonstandard stimulus/monitor cards. 30 card slots are provided. Typical cards are analog cards (8/card), discrete indications (16/card), and discrete stimuli (8/card). Inputs to the HIM are processed and result in commands decoded, transmitted, and performed in the GSE or result in monitoring functions being performed, encoded and transmitted to the LPS.</u>			
DIMENSIONS (FT) <u>2½</u> L <u>2</u> W <u>6½</u> H    POWER <u>28</u> VDC or <u>120</u> V <u>60</u> Hz <u>1</u> <u>0</u> KW WEIGHT (LBS) _____ FLUID REQUIREMENTS <u>None</u> PSIG <u>N/A</u> QUAN. <u>N/A</u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>GSE</u>			
VEHICLE INTERFACE <u>None (may interface T-4 umbilical)</u>			
FACILITY INTERFACE <u>Power, signal transmission lines</u>			
OTHER INTERFACING GSE <u>HIM distributor, power amplification and switching GSE</u>			
MOBILITY REQUIREMENTS <u>Fixed</u>			
OPERATIONAL MODE:    LOCAL _____ REMOTE _____ BOTH <u>x</u> DETAILS <u>Primary</u> <u>Mode is Remote</u>			
SOFTWARE REQUIREMENTS <u>None</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input checked="" type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR    ETR
REMARKS <u>Part of CCMS which is part of the LPS. For details, see KSC-LPS-RD-026 (8-9-74) Pgs 172 thru 263.</u>			16    16
		TOTAL REQUIRED	16    16

# TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Tug Workstand</u>		ITEM NO. <u>H-001</u>		
REQUIREMENT SUMMARY <u>Tug Post-Flight safing and damage inspection, cleaning, maintenance and refurbishment, checkout, and when applicable, spacecraft mate and payload checkout.</u>				
ITEM DESCRIPTION <u>A multiple level vertical workstand with provision for Tug refurbishment and checkout. Hinged/removal sections permit access, removal, and replacement of Adapter Tug Engine Kick Stage and spacecraft. Platforms will permit access to all areas of the intertank area without restricting clearance through access doors. Workstand will support the Tug and provide space for installation of checkout GSE.</u>				
DIMENSIONS (FT) <u>25</u> L <u>70</u> W <u>75</u> H POWER <u>N/A</u> V <u>  </u> Hz <u>0</u> KW				
WEIGHT (LBS) <u>  </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u>  </u> QUAN. <u>  </u>				
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug, Adapter, Kick Stage, and Spacecraft</u>				
VEHICLE INTERFACE <u>  </u>				
FACILITY INTERFACE <u>Tug Processing Facility Airlock and Checkout Area</u>				
OTHER INTERFACING GSE <u>Provide space for leak test equipment, carry near equipment, etc.</u>				
MOBILITY REQUIREMENTS <u>None</u>				
OPERATIONAL MODE: LOCAL <u>  </u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>				
SOFTWARE REQUIREMENTS <u>N/A</u>				
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:		
NEW <input checked="" type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY	
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR	ETR
REMARKS <u>See attached figure.</u>		<u>1.4, 2.9, 4.3, 4.12, 5.22</u>	<u>1</u>	<u>3</u>
		TOTAL REQUIRED	<u>1</u>	<u>3</u>

# TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Engine Workstand</u>		ITEM NO. <u>H-002</u>	
REQUIREMENT SUMMARY <u>Support the Tug engine and provide working access to engine when removed from the Tug.</u>			
ITEM DESCRIPTION <u>Provide attach points and support the Tug engine when it is separated from the Tug. Provide physical access to all areas of the Tug engine and provide support for personnel, servicing, and checkout equipment.</u>			
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H <u>  </u>		POWER <u>N/A</u> V <u>  </u> Hz <u>  </u> <u>0</u> KW	
WEIGHT (LBS) <u>  </u>		FLUID REQUIREMENTS <u>N/A</u> PSIG <u>  </u> QUAN. <u>  </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug Engine</u>			
VEHICLE INTERFACE <u>N/A</u>			
FACILITY INTERFACE <u>N/A</u>			
OTHER INTERFACING GSE <u>Carry near engine checkout GSE.</u>			
MOBILITY REQUIREMENTS <u>N/A</u>			
OPERATIONAL MODE: LOCAL <u>  </u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input checked="" type="checkbox"/>		FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			WTR
REMARKS			
<u>Used for maintenance and refurbishment</u>			
TOTAL REQUIRED			<u>2</u>

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Deployment Adapter Workstand</u>		ITEM NO. <u>II-003</u>	
REQUIREMENT SUMMARY <u>Provide support for personnel and equipment during</u> <u>Deployment Adapter inspection, maintenance, refurbishment, and checkout.</u>			
ITEM DESCRIPTION <u>Provide working platforms for inspection, maintenance, refurbish,</u> <u>and checkout of the Deployment Adapter. The workstand contains cut-outs to</u> <u>accommodate the Deployment Adapter on its dolly. The workstand will provide</u> <u>access to all areas of the Adapter.</u>			
DIMENSIONS (FT) <u>24</u> L <u>24</u> W <u>10</u> H POWER <u>N/A</u> V <u>  </u> Hz <u>  </u> KW <u>  </u>			
WEIGHT (LBS) <u>  </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u>  </u> QUAN. <u>  </u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>Personnel &amp; Equipment</u>			
VEHICLE INTERFACE <u>N/A</u>			
FACILITY INTERFACE <u>  </u>			
OTHER INTERFACING GSE <u>  </u>			
MOBILITY REQUIREMENTS <u>N/A</u>			
OPERATIONAL MODE: LOCAL <u>  </u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR
REMARKS		<u>2.13, 2.15</u>	<u>2</u>
		TOTAL REQUIRED	<u>2</u>

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Tug Transportation Dolly</u>		ITEM NO. <u>H-004</u>	
REQUIREMENT SUMMARY <u>Ground Transportation of Tug, Tug and adapter.</u>			
ITEM DESCRIPTION <u>Wheel mounted chassis that mate with Tug Orbiter attach points.</u>			
<u>for ground transportation,</u>			
DIMENSIONS (FT) <u>40</u> L <u>16</u> W <u>11</u> H		POWER <u>N/A</u> V <u> </u> Hz <u>0</u> KW	
WEIGHT (LBS) <u> </u>		FLUID REQUIREMENTS <u>N/A</u> PSIG <u> </u> QUAN. <u> </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug and Adapter</u>			
VEHICLE INTERFACE <u>Tug to Orbiter attach points on Tug.</u>			
FACILITY INTERFACE <u> </u>			
OTHER INTERFACING GSE <u> </u>			
MOBILITY REQUIREMENTS <u>Over-the-road capability</u>			
OPERATIONAL MODE: LOCAL <u> </u> REMOTE <u> </u> BOTH <u> </u> DETAILS <u> </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			
REMARKS <u>See attached Figure.</u>		<u>4.3, 4.11, 5.12, 5.13, 5.14,</u>	QUANTITY
		<u>5.16</u>	WTR ETR
		TOTAL REQUIRED	2

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Cargo Bay Work Platform Set</u>		ITEM NO. <u>H-005</u>		
REQUIREMENT SUMMARY <u>Provide physical access to Tug in Orbiter Cargo Bay.</u>				
<u>Two sets required: 1) vertical and 2) horizontal.</u>				
ITEM DESCRIPTION <u>Provide access to and working room around the Tug following installation and before removal from the Orbiter bay. Platforms will support personnel and carry-near GSE and will utilize cargo bay load bearing structures for attach points.</u>				
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H <u>  </u> POWER <u>N/A</u> V <u>  </u> Hz <u>  </u> $\theta$ <u>  </u> KW <u>  </u>				
WEIGHT (LBS) <u>  </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u>  </u> QUAN. <u>  </u>				
ARTICLE OR ASSEMBLY SUPPORTED <u>Personnel and carry-over GSE</u>				
VEHICLE INTERFACE <u>N/A</u>				
FACILITY INTERFACE <u>N/A</u>				
OTHER INTERFACING GSE <u>N/A</u>				
MOBILITY REQUIREMENTS <u>N/A</u>				
OPERATIONAL MODE: LOCAL <u>  </u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>				
SOFTWARE REQUIREMENTS <u>N/A</u>				
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:		
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY	
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR	ETR
REMARKS		1.1	1	2
		TOTAL REQUIRED	1	2

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Internal Platforms</u>		ITEM NO. <u>H-006</u>	
REQUIREMENT SUMMARY <u>Provide physical access to all areas in the intertank section, portable and attach to Tug structure and Tug Workstand.</u>			
ITEM DESCRIPTION <u>Portable platforms that can be placed in the intertank areas to provide access to all areas for inspection, refurbishment, and repair. The platforms allow access without restriction, clearance through access doors.</u>			
DIMENSIONS (FT) <u>    </u> L <u>    </u> W <u>    </u> H		POWER <u>N/A</u> V <u>    </u> Hz <u>0</u> KW	
WEIGHT (LBS) <u>    </u>		FLUID REQUIREMENTS <u>N/A</u> PSIG <u>    </u> QUAN. <u>    </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>Personnel</u>			
VEHICLE INTERFACE <u>Interface Structure</u>			
FACILITY INTERFACE <u>    </u>			
OTHER INTERFACING GSE <u>Tug Workstands</u>			
MOBILITY REQUIREMENTS <u>N/A</u>			
OPERATIONAL MODE: LOCAL <u>    </u> REMOTE <u>    </u> BOTH <u>    </u> DETAILS <u>    </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			
REMARKS		QUANTITY	
		WTR ETR	
		2	
TOTAL REQUIRED		2	



## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Deployment Adapter Dolly</u>		ITEM NO. <u>H-007</u>	
REQUIREMENT SUMMARY <u>Ground transportation of Deployment Adapter, provide adapter support for Tug-Adapter demate and mate operations, provide capability to rotate adapter.</u>			
ITEM DESCRIPTION <u>Wheel mounted chassis that mates with Deployment Adapter at the Orbiter attachment fitting, providing mate and demate capabilities, access for inspection, maintenance, refurbishment, and checkout. The Dolly provides capability to rotate the Adapter 180 degrees.</u>			
DIMENSIONS (FT) <u>16</u> L <u>16</u> W <u>11</u> H		POWER <u>N/A</u> V <u> </u> Hz <u>0</u> KW	
WEIGHT (LBS) <u> </u>		FLUID REQUIREMENTS <u>N/A</u> PSIG <u> </u> QUAN. <u> </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>Deployment Adapter</u>			
VEHICLE INTERFACE <u>Deployment Adapter Orbiter Attach Fitting</u>			
FACILITY INTERFACE <u> </u>			
OTHER INTERFACING GSE <u> </u>			
MOBILITY REQUIREMENTS <u>Over-the-road capability</u>			
OPERATIONAL MODE: LOCAL <u> </u> REMOTE <u> </u> BOTH <u> </u> DETAILS <u> </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			
REMARKS <u>See attached figure.</u>		QUANTITY	
		WTR ETR	
		<u>2.6, 2.13, 2.14</u>	
		<u>3</u>	
TOTAL REQUIRED		<u>3</u>	

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Deployment Adapter Protective Cover Kit</u>		ITEM NO. <u>H-008</u>	
REQUIREMENT SUMMARY <u>Sealable cover for Deployment Adapter providing protection from moisture and maintaining cleanliness.</u>			
ITEM DESCRIPTION <u>Two layer cover with inner layer made from impervious material with sealable closures. The outer cover is a heavy fabric covering the Adapter and attaching to the Adapter Dolly. The kit includes a free breathing desiccant assembly with air filters to maintain cleanliness.</u>			
DIMENSIONS (FT) <u>    </u> L <u>    </u> W <u>    </u> H POWER <u>N/A</u> V <u>    </u> Hz <u>0</u> KW			
WEIGHT (LBS) <u>    </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u>    </u> QUAN. <u>    </u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>    </u>			
VEHICLE INTERFACE <u>External cover for Deployment Adapter</u>			
FACILITY INTERFACE <u>    </u>			
OTHER INTERFACING GSE <u>N/A</u>			
MOBILITY REQUIREMENTS <u>N/A</u>			
OPERATIONAL MODE: LOCAL <u>    </u> REMOTE <u>    </u> BOTH <u>    </u> DETAILS <u>    </u>			
SOFTWARE REQUIREMENTS <u>    </u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR
REMARKS			
<u>Used for storage</u>			
TOTAL REQUIRED			3

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Spacecraft Adapter Transport/Storage Pallet</u>		ITEM NO. <u>H-009</u>	
REQUIREMENT SUMMARY <u>Transportation/Storage support for Spacecraft adapter when removed from Tug.</u>			
ITEM DESCRIPTION <u>A rigid pallet with lifting lugs and protective cover on which the Spacecraft adapter is placed for transportation and storage.</u>			
DIMENSIONS (FT) <u>15</u> L <u>15</u> W <u>2</u> H		POWER <u>N/A</u> V <u>  </u> Hz <u>0</u> KW	
WEIGHT (LBS) <u>  </u>		FLUID REQUIREMENTS <u>N/A</u> PSIG <u>  </u> QUAN. <u>  </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>Spacecraft Adapter</u>			
VEHICLE INTERFACE <u>  </u>			
FACILITY INTERFACE <u>  </u>			
OTHER INTERFACING GSE <u>Handling Sling Kit</u>			
MOBILITY REQUIREMENTS <u>  </u>			
OPERATIONAL MODE: LOCAL <u>  </u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>		QUANTITY	
REMARKS		WTR	ETR
			5
TOTAL REQUIRED			5

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Kick Stage Protective Cover Kit</u>		ITEM NO. <u>H-010</u>	
REQUIREMENT SUMMARY <u>Sealable covers for kick stage and SRM providing protection from moisture and maintaining cleanliness.</u>			
ITEM DESCRIPTION <u>Two layer cover with inner cover made from impervious material with sealable closures. The outer cover is a heavy fabric covering the stage and attaching to the supporting fixture. The kit includes a free breathing desiccant assembly with air filters to maintain a class 100,000 clean environment during shipment or storage.</u>			
DIMENSIONS (FT) <u>    </u> L <u>    </u> W <u>    </u> H POWER <u>N/A</u> V <u>    </u> Hz <u>    </u> <u>0</u> KW			
WEIGHT (LBS) <u>    </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u>    </u> QUAN. <u>    </u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>Kick Stage and SRM</u>			
VEHICLE INTERFACE <u>External covers for stage and SRM.</u>			
FACILITY INTERFACE <u>    </u>			
OTHER INTERFACING GSE <u>Handling Sling Kit</u>			
MOBILITY REQUIREMENTS <u>N/A</u>			
OPERATIONAL MODE: LOCAL <u>X</u> REMOTE <u>    </u> BOTH <u>    </u> DETAILS <u>    </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR
REMARKS		<u>4.30</u>	<u>3</u>
		TOTAL REQUIRED	<u>3</u>

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Kick Stage Motor Cradle</u>		ITEM NO. <u>H-011</u>	
REQUIREMENT SUMMARY <u>Support SRM for inspection, cleaning, and checkout.</u> <u>Provide access provision to all areas of SRM.</u>			
ITEM DESCRIPTION <u>Rigid structure supporting the SRM in a vertical position for inspection, cleaning, and checkout. The structure will provide access and platforms to support personnel and GSE in SRM processing.</u>			
DIMENSIONS (FT) <u>    </u> L <u>    </u> W <u>    </u> H		POWER <u>N/A</u> V <u>    </u> Hz <u>    </u>	<u>0</u> KW
WEIGHT (LBS) <u>    </u>		FLUID REQUIREMENTS <u>N/A</u> PSIG <u>    </u>	QUAN. <u>    </u>
ARTICLE OR ASSEMBLY SUPPORTED <u>Kick Stage Solid Rocket Motor</u>			
VEHICLE INTERFACE <u>SRM attach/handling points</u>			
FACILITY INTERFACE <u>    </u>			
OTHER INTERFACING GSE <u>Handling Sling Kit</u>			
MOBILITY REQUIREMENTS <u>N/A</u>			
OPERATIONAL MODE: LOCAL <u>X</u> REMOTE <u>    </u> BOTH <u>    </u> DETAILS <u>    </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			WTR ETR
REMARKS		<u>4.34</u>	<u>3</u>
		TOTAL REQUIRED	<u>3</u>

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Kick Stage Buildup/Checkout Fixture</u>		ITEM NO. <u>H-012</u>	
REQUIREMENT SUMMARY <u>Support Kick Stage in vertical orientation for component installation, motor installation, cleaning, and checkout.</u>			
ITEM DESCRIPTION <u>Rigid structure providing attachment points to support the kick stage in the vertical position structure will provide access to all areas of the kick stage for cleaning, component installation/removal, engine installation and ground checkout. Lifting lugs will be provided for movement with or without Tug installed.</u>			
DIMENSIONS (FT) <u>16</u> L <u>16</u> W <u>  </u> H POWER <u>N/A</u> V <u>  </u> Hz <u>0</u> KW			
WEIGHT (LBS) <u>  </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u>  </u> QUAN. <u>  </u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>Kick Stage</u>			
VEHICLE INTERFACE <u>Kick Stage handling attachments</u>			
FACILITY INTERFACE <u>  </u>			
OTHER INTERFACING GSE <u>Handling Sling Kit</u>			
MOBILITY REQUIREMENTS <u>N/A</u>			
OPERATIONAL MODE: LOCAL <input checked="" type="checkbox"/> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR
REMARKS		4.37	3
		TOTAL REQUIRED	3

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Kick Stage SRM Storage Pallet</u>		ITEM NO. <u>H-013</u>	
REQUIREMENT SUMMARY <u>Support the SRM and its protective cover during storage.</u>			
ITEM DESCRIPTION <u>A rigid frame supporting the Tug and its protective cover in a vertical position.</u>			
DIMENSIONS (FT) <u>10</u> L <u>10</u> W <u>5</u> H POWER <u>N/A</u> V <u> </u> Hz <u>0</u> KW			
WEIGHT (LBS) <u> </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u> </u> QUAN. <u> </u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>SRM</u>			
VEHICLE INTERFACE <u>SRM Handling/Attachment Points</u>			
FACILITY INTERFACE <u>N/A</u>			
OTHER INTERFACING GSE <u>Handling Sling Kit</u>			
MOBILITY REQUIREMENTS <u>N/A</u>			
OPERATIONAL MODE: LOCAL <u>X</u> REMOTE <u> </u> BOTH <u> </u> DETAILS <u> </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>		QUANTITY	
REMARKS		WTR	ETR
<u>Used for storage</u>			
TOTAL REQUIRED			4

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Kick Stage Storage Pallet</u>		ITEM NO. <u>H-014</u>		
REQUIREMENT SUMMARY <u>Support Kick Stage during storage periods.</u>				
ITEM DESCRIPTION <u>A rigid platform supporting the kick stage in its protective cover in a horizontal position.</u>				
DIMENSIONS (FT) <u>15</u> L <u>15</u> W <u>2</u> H POWER <u>N/A</u> V <u>  </u> Hz <u>0</u> KW				
WEIGHT (LBS) <u>  </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u>  </u> QUAN. <u>  </u>				
ARTICLE OR ASSEMBLY SUPPORTED <u>Kick Stage</u>				
VEHICLE INTERFACE <u>Kick Stage Aft Ring</u>				
FACILITY INTERFACE <u>  </u>				
OTHER INTERFACING GSE <u>Handling Sling Kit</u>				
MOBILITY REQUIREMENTS <u>N/A</u>				
OPERATIONAL MODE: LOCAL <u>X</u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>				
SOFTWARE REQUIREMENTS <u>N/A</u>				
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:		
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY	
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR	ETR
REMARKS				
<u>Used for storage</u>				
TOTAL REQUIRED			3	



## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Tug Storage Pallet</u>		ITEM NO. <u>H-015</u>	
REQUIREMENT SUMMARY <u>Support Tug during periods of Storage - Attaches to Tug at normal Orbiter attach points.</u>			
ITEM DESCRIPTION <u>A rigid frame supporting the Tug and its Protective Cover in a horizontal position.</u>			
DIMENSIONS (FT) <u>32</u> L <u>16</u> W <u>8</u> H		POWER <u>N/A</u> V <u>  </u> Hz <u>0</u> KW	
WEIGHT (LBS) <u>  </u>		FLUID REQUIREMENTS <u>N/A</u> PSIG <u>  </u> QUAN. <u>  </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug &amp; Protective Cover</u>			
VEHICLE INTERFACE <u>Orbiter attach points.</u>			
FACILITY INTERFACE <u>  </u>			
OTHER INTERFACING GSE <u>Tug Lifting Rings</u>			
MOBILITY REQUIREMENTS <u>N/A</u>			
OPERATIONAL MODE: LOCAL <u>  </u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			WTR ETR
REMARKS			
<u>Used for storage</u>			
TOTAL REQUIRED			6

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Tug Engine Handling Kit</u>		ITEM NO. <u>H-016</u>	
REQUIREMENT SUMMARY <u>Install and remove engine from Tug and provide support for engine during refurbishment or checkout when removed from Tug.</u>			
ITEM DESCRIPTION <u>A rigid engine mounting fixture equipment with lifting lugs and a mechanism for rotating and tilting the engine for maintenance, checkout, and installation on the Tug.</u>			
DIMENSIONS (FT) <u>10</u> L <u>8</u> W <u>10</u> H		POWER <u>N/A</u> V <u>  </u> Hz <u>0</u> KW	
WEIGHT (LBS) <u>  </u>		FLUID REQUIREMENTS <u>N/A</u> PSIG <u>  </u> QUAN. <u>  </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug Engine</u>			
VEHICLE INTERFACE <u>Tug Engine Handling Points</u>			
FACILITY INTERFACE <u>N/A</u>			
OTHER INTERFACING GSE <u>Handling Sling Kit</u>			
MOBILITY REQUIREMENTS <u>N/A</u>			
OPERATIONAL MODE: LOCAL <u>X</u> <input checked="" type="checkbox"/> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			
REMARKS		QUANTITY	
		WTR ETR	
<u>Used for maintenance and refurbishment</u>			
TOTAL REQUIRED		2	

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Deployment Adapter Storage Pallet</u>		ITEM NO. <u>H-017</u>	
REQUIREMENT SUMMARY <u>Support the Deployment Adapter during periods of storage.</u>			
ITEM DESCRIPTION <u>A rigid platform on which the Adapter is placed and covered during storage. Attach points are provided for moving platform with or without Adapter installed.</u>			
DIMENSIONS (FT) <u>15</u> L <u>15</u> W <u>8</u> H POWER <u>N/A</u> V <u> </u> Hz <u>0</u> KW <u> </u>			
WEIGHT (LBS) <u> </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u> </u> QUAN. <u> </u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>Deployment Adapter</u>			
VEHICLE INTERFACE <u>Intertank Skirt Interface Ring</u>			
FACILITY INTERFACE <u> </u>			
OTHER INTERFACING GSE <u>Handling Sling Kit</u>			
MOBILITY REQUIREMENTS <u> </u>			
OPERATIONAL MODE: LOCAL <u> </u> REMOTE <u> </u> BOTH <u> </u> DETAILS <u> </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			
REMARKS		QUANTITY	
Used for storage		WTR ETR	
TOTAL REQUIRED		5	

# TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Handling Sling Kit</u>		ITEM NO. <u>H-018</u>	
REQUIREMENT SUMMARY <u>Cable assemblies and associated hardware to lift and handle the Tug, Tug/SC, Deployment Adapter, Kick Stage, and other GSE.</u>			
ITEM DESCRIPTION <u>Consists of cable assemblies, attachment fittings, spreader bars used for lifting the Tug and Tug/SC, Deployment Adapter, Kick Stage, and other supporting, handling, and checkout GSE.</u>			
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H		POWER <u>N/A</u> V <u>  </u> Hz <u>  </u> $\theta$ <u>  </u> KW	
WEIGHT (LBS) <u>  </u>		FLUID REQUIREMENTS <u>N/A</u> PSIG <u>  </u> QUAN. <u>  </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug &amp; Tug/SC</u>			
VEHICLE INTERFACE <u>Tug</u>			
FACILITY INTERFACE <u>OPF, TPF</u>			
OTHER INTERFACING GSE <u>Covers, handling rings, spreader bars, etc.</u>			
MOBILITY REQUIREMENTS <u>N/A</u>			
OPERATIONAL MODE: LOCAL <input checked="" type="checkbox"/> REMOTE <input type="checkbox"/> BOTH <input type="checkbox"/> DETAILS <input type="checkbox"/>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>		QUANTITY	
REMARKS		WTR	ETR
TOTAL REQUIRED		1	3

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Tug Protective Cover Kit</u>		ITEM NO. <u>H-019</u>	
REQUIREMENT SUMMARY <u>Sealable covers for Tug/Adapter providing protection from moisture and maintaining cleanliness.</u>			
ITEM DESCRIPTION <u>Two layer cover with the inner cover made from impervious material with sealable closures to enhance cleanliness. The outer cover is a heavy fabric covering the Tug and attaching to a supporting fixture. The kit includes a free breathing desiccant assembly with air filters to maintain a class 100 700 clean environment during shipment or storage.</u>			
DIMENSIONS (FT) <u>30'</u> L <u>15</u> W <u>15</u> H POWER <u>N/A</u> V <u> </u> Hz <u>0</u> KW			
WEIGHT (LBS) <u> </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u> </u> QUAN. <u> </u>			
ARTICLE OR ASSEMBLY SUPPORTED <u> </u>			
VEHICLE INTERFACE <u>External cover for Tug &amp; Adapter</u>			
FACILITY INTERFACE <u> </u>			
OTHER INTERFACING GSE <u>Desiccant Kit</u>			
MOBILITY REQUIREMENTS <u>Attaches to Tug Transportation GSE</u>			
OPERATIONAL MODE: LOCAL <u> </u> REMOTE <u> </u> BOTH <u> </u> DETAILS <u> </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			
REMARKS <u>See attached Figure.</u>		<u>1.2, 2.21, 5.13, 5.14, 5.22,</u>	QUANTITY WTR ETR
			1 6
		TOTAL REQUIRED	1 6

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Tug Desiccant Kit</u>		ITEM NO. <u>H-020</u>	
REQUIREMENT SUMMARY <u>Provide dry air breathing capability to Tug propulsion tanks, pressure vessels, fuel cell reactant tanks, and purge bays.</u>			
ITEM DESCRIPTION <u>Desiccant breather assemblies with associated disconnects, flexible and rigid ducts to attach to Tug pressure/propellant/reactant vessels. The kit will fit inside of the Tug Protective Cover Kit.</u>			
DIMENSIONS (FT) <u>    </u> L <u>    </u> W <u>    </u> H		POWER <u>N/A</u> V <u>    </u> Hz <u>0</u> KW	
WEIGHT (LBS) <u>    </u>		FLUID REQUIREMENTS <u>N/A</u> PSIG <u>    </u> QUAN. <u>    </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>    </u>			
VEHICLE INTERFACE <u>Tug-Orbiter interface connectors and APS Vent.</u>			
FACILITY INTERFACE <u>    </u>			
OTHER INTERFACING GSE <u>    </u>			
MOBILITY REQUIREMENTS <u>Air transportable attached to Tug (rapid breathing)</u>			
OPERATIONAL MODE: LOCAL <u>    </u> REMOTE <u>    </u> BOTH <u>    </u> DETAILS <u>    </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR
REMARKS <u>Also utilized during storage</u>		<u>4.2, 4.49</u>	<u>6</u>
TOTAL REQUIRED			<u>6</u>

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Battery Handling Kit</u>		ITEM NO. <u>H-021</u>	
REQUIREMENT SUMMARY <u>Move and assist in installation and removal of flight batteries.</u>			
ITEM DESCRIPTION <u>The battery kit consists of a manipulator, carrier, handler, and fastening devices mounted on a dolly.</u>			
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H <u>  </u>		POWER <u>N/A</u> V <u>  </u> Hz <u>0</u> KW <u>  </u>	
WEIGHT (LBS) <u>  </u>		FLUID REQUIREMENTS <u>N/A</u> PSIG <u>  </u> QUAN. <u>  </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>Flight batteries</u>			
VEHICLE INTERFACE <u>Flight batteries</u>			
FACILITY INTERFACE <u>N/A</u>			
OTHER INTERFACING GSE <u>N/A</u>			
MOBILITY REQUIREMENTS <u>Mobile dolly</u>			
OPERATIONAL MODE: LOCAL <u>x</u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			WTR ETR
REMARKS		1.7, 5.7	1 3
TOTAL REQUIRED		1	3

NAS8-31011 8 74 (PRELIMINARY)

NAME <u>Air Carry Tiedown Kit</u>		ITEM NO. <u>H-022</u>	
REQUIREMENT SUMMARY <u>Secure Tug transportation fixture in cargo area of airplane.</u>			
ITEM DESCRIPTION <u>The air carry tiedown kit contains the cable assemblies and attach fittings used to secure the Tug, mounted on the Tug Trantainer, in the cargo area of an airplane.</u>			
DIMENSIONS (FT) L <u>    </u> W <u>    </u> H <u>    </u> POWER <u>N/A</u> V <u>    </u> Hz <u>    </u> <u>0</u> KW <u>    </u>			
WEIGHT (LBS) <u>    </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u>    </u> QUAN. <u>    </u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug</u>			
VEHICLE INTERFACE <u>N/A</u>			
FACILITY INTERFACE <u>Airplane Cargo Bay</u>			
OTHER INTERFACING GSE <u>Tug Transtainer</u>			
MOBILITY REQUIREMENTS <u>N/A</u>			
OPERATIONAL MODE: LOCAL <input checked="" type="checkbox"/> REMOTE <input type="checkbox"/> BOTH <input type="checkbox"/> DETAILS <input type="checkbox"/>			
SOFTWARE REQUIREMENTS <u>N/A</u>			

EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR
REMARKS		2.23, 4.1, 4.51	1      2
TOTAL REQUIRED		1	2



## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Transport Data Recorder</u>		ITEM NO. <u>H-023</u>	
REQUIREMENT SUMMARY <u>Record Temperature, humidity, shock during long range transportation functions</u>			
ITEM DESCRIPTION <u>Multi-channel analog recorder that will accompany the Tug during transportation between launch sites, from factory to launch site or from alternate sites to SHA. It will record the environmental conditions surrounding the Tug, i.e. time, temperature, humidity, shock (acceleration)</u>			
DIMENSIONS (FT) <u>2.5</u> L <u>2</u> W <u>1.5</u> H POWER <u>N/A</u> V <u>  </u> Hz <u>6</u> KW			
WEIGHT (LBS) <u>  </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u>  </u> QUAN. <u>  </u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug</u>			
VEHICLE INTERFACE <u>  </u>			
FACILITY INTERFACE <u>  </u>			
OTHER INTERFACING GSE <u>  </u>			
MOBILITY REQUIREMENTS <u>Carry-near, air transportable</u>			
OPERATIONAL MODE: LOCAL <u>x</u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/>	COMMERCIAL <input checked="" type="checkbox"/>		WTR
REMARKS		<u>2.24, 4.2, 4.49</u>	<u>2</u>
		TOTAL REQUIRED	<u>2</u>

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Tug Transtainer</u>		ITEM NO. <u>H-024</u>	
REQUIREMENT SUMMARY <u>Support long distance air transport of Tug, include environmental control equipment</u>			
ITEM DESCRIPTION <u>Low profile trailer capable of supporting a covered Tug during air transportation required by manufacturing location or orbiter landing at an alternate site. Wheels are hydraulically retractable and tie downs are provided for attachment to the aircraft.</u>			
DIMENSIONS (FT) <u>32</u> L <u>16</u> W <u>6</u> H POWER <u>N/A</u> V <u>  </u> Hz <u>0</u> KW			
WEIGHT (LBS) <u>  </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u>  </u> QUAN. <u>  </u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug and adapter and spacecraft</u>			
VEHICLE INTERFACE <u>Tug and adapter orbiter attach points</u>			
FACILITY INTERFACE <u>N/A</u>			
OTHER INTERFACING GSE <u>Handling Sling Kit</u>			
MOBILITY REQUIREMENTS <u>Retractable wheels for ground transportation and stable mounting in aircraft</u>			
OPERATIONAL MODE: LOCAL <u>x</u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR
REMARKS		1.1, 1.4, 2.21, 2.22,	
		4.49, 4.50, 5.9, 5.22	1 2
		TOTAL REQUIRED	1 2

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Tug Lifting Rings</u>		ITEM NO. <u>H-025</u>	
REQUIREMENT SUMMARY <u>Provide lifting points for Tug and support points for Tug in the horizontal position.</u>			
ITEM DESCRIPTION <u>Two rings, fore and aft, used to provide lifting points for the Tug. The rings are segmented for ease of handling, installation and removal. The rings are also used to provide support points for the Tug in the horizontal position.</u>			
DIMENSIONS (FT) <u>      </u> L <u>      </u> W <u>      </u> H		POWER <u>N/A</u> V <u>      </u> Hz <u>0</u> KW	
WEIGHT (LBS) <u>      </u>		FLUID REQUIREMENTS <u>N/A</u> PSIG <u>      </u> QUAN. <u>      </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug</u>			
VEHICLE INTERFACE <u>Tug</u>			
FACILITY INTERFACE <u>      </u>			
OTHER INTERFACING GSE <u>Tug Workstands, Handling Sling Kit</u>			
MOBILITY REQUIREMENTS <u>      </u>			
OPERATIONAL MODE: LOCAL <u>      </u> REMOTE <u>      </u> BOTH <u>      </u> DETAILS <u>      </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			
REMARKS		1.1, 4.3, 5.9, 5.12, 5.22	QUANTITY
			WTR ETR
			1 3
TOTAL REQUIRED		1	3

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Inspection Workstands</u>		ITEM NO. <u>H-026</u>	
REQUIREMENT SUMMARY <u>Portable Work Platforms to be positioned as required to provide access to Tug/kick stage/spacecraft.</u>			
ITEM DESCRIPTION <u>The workstands will be portable and self supporting. They will be used at random to provide access for inspection, hardware removal/replacement, and final closeout activities.</u>			
DIMENSIONS (FT) _____ L _____ W _____ H _____	POWER <u>N/A</u> V _____ Hz _____	<u>0</u> KW	
WEIGHT (LBS) _____	FLUID REQUIREMENTS _____	<u>N/A</u> PSIG	QUAN. _____
ARTICLE OR ASSEMBLY SUPPORTED <u>Personnel</u>			
VEHICLE INTERFACE _____			
FACILITY INTERFACE _____			
OTHER INTERFACING GSE <u>Tug workstands</u>			
MOBILITY REQUIREMENTS <u>N/A</u>			
OPERATIONAL MODE: LOCAL _____ REMOTE _____ BOTH _____ DETAILS _____			
SOFTWARE REQUIREMENTS _____			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO. _____	QUANTITY
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR   ETR
REMARKS		<u>1.2, 1.3, 2.9, 4.12, 2.7</u>	<u>1   9</u>
		TOTAL REQUIRED	<u>1   9</u>

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Spacecraft Docking Simulator</u>		ITEM NO. <u>H-027</u>	
REQUIREMENT SUMMARY <u>The simulator will be required to verify the Tug/kick stage to spacecraft interface integrity.</u>			
ITEM DESCRIPTION <u>The simulator will have the capability to determine latching retention forces and interface latching integrity.</u>			
DIMENSIONS (FT) _____ L _____ W _____ H _____		POWER _____ V _____ Hz _____ $\theta$ _____ KW	
WEIGHT (LBS) _____		FLUID REQUIREMENTS _____ PSIG _____ QUAN. _____	
ARTICLE OR ASSEMBLY SUPPORTED _____			
VEHICLE INTERFACE _____			
FACILITY INTERFACE _____			
OTHER INTERFACING GSE _____			
MOBILITY REQUIREMENTS _____			
OPERATIONAL MODE: LOCAL _____ REMOTE _____ BOTH _____ DETAILS _____			
SOFTWARE REQUIREMENTS _____			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>		QUANTITY	
REMARKS		WTR	ETR
			1
TOTAL REQUIRED			1

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Kick Stage Transtainer</u>		ITEM NO. <u>H-028</u>	
REQUIREMENT SUMMARY <u>Support long distance air transport of the kick stage, including environmental control.</u>			
ITEM DESCRIPTION <u>Low profile trailer capable of supporting a covered transtainer during air transportation required by manufacturing location or orbiter landing at an alternate site. Wheels are hydraulically retractable and tie downs are provided for attachment to the aircraft.</u>			
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H <u>  </u> POWER <u>N/A</u> V <u>  </u> Hz <u>  </u> $\theta$ <u>  </u> KW			
WEIGHT (LBS) <u>  </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u>  </u> QUAN. <u>  </u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>Kick Stage</u>			
VEHICLE INTERFACE <u>  </u>			
FACILITY INTERFACE <u>  </u>			
OTHER INTERFACING GSE <u>  </u>			
MOBILITY REQUIREMENTS <u>Over the road</u>			
OPERATIONAL MODE: LOCAL <u>  </u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>  </u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR
REMARKS		4.30, 4.48	2
		TOTAL REQUIRED	2

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Vertical Adapter</u>		ITEM NO. <u>H-029</u>		
REQUIREMENT SUMMARY <u>Provide support and interfaces to permit elevator handling of Tug/Payload.</u>				
ITEM DESCRIPTION <u>Fixture that interfaces with PCU elevator system providing attachment points for the Tug. Provides access to permit manipulator to mate with and remove Tug from fixture.</u>				
DIMENSIONS (FT) <u>18</u> L <u>18</u> W <u>35</u> H POWER <u>N/A</u> V <u> </u> Hz <u>0</u> KW				
WEIGHT (LBS) <u> </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u> </u> QUAN. <u> </u>				
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug/Payload</u>				
VEHICLE INTERFACE <u>Tug-Orbiter attach points</u>				
FACILITY INTERFACE <u>PCU elevator</u>				
OTHER INTERFACING GSE <u>PCR payload manipulator</u>				
MOBILITY REQUIREMENTS <u>Installation/Removal on/from elevator</u>				
OPERATIONAL MODE: LOCAL <u>X</u> REMOTE <u> </u> BOTH <u> </u> DETAILS <u> </u>				
SOFTWARE REQUIREMENTS <u>N/A</u>				
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:		
NEW <input checked="" type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY	
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR	ETR
REMARKS		5.23, 5.24	1	
		TOTAL REQUIRED	1	

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Kick Stage Motor Support Fixture</u>		ITEM NO. <u>H-030</u>		
REQUIREMENT SUMMARY <u>Provide support for and access to kick stage motor.</u>				
ITEM DESCRIPTION <u>Support fixture to support kick stage motor in a vertical position</u>				
<u>position for inspection and cleaning. Access platforms to permit physical</u>				
<u>access to all external areas of motor.</u>				
DIMENSIONS (FT) <u>16</u> L <u>16</u> W <u>12</u> H POWER <u>N/A</u> V <u>  </u> Hz <u>  </u> KW <u>  </u>				
WEIGHT (LBS) <u>  </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u>  </u> QUAN. <u>  </u>				
ARTICLE OR ASSEMBLY SUPPORTED <u>Kick Stage Motor</u>				
VEHICLE INTERFACE <u>Motor - Stage attach brackets</u>				
FACILITY INTERFACE <u>N/A</u>				
OTHER INTERFACING GSE <u>N/A</u>				
MOBILITY REQUIREMENTS <u>N/A</u>				
OPERATIONAL MODE: LOCAL <u>X</u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>				
SOFTWARE REQUIREMENTS <u>N/A</u>				
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:		
NEW <input checked="" type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY	
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR	ETR
REMARKS		4.34		3
TOTAL REQUIRED			3	



## TUG GSF REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>TPF Manipulator Option 1</u>		ITEM NO. <u>H-031</u>	
REQUIREMENT SUMMARY _____			
ITEM DESCRIPTION <u>A vehicle similar in appearance and function to a fork lift truck. In place of the familiar tine this vehicle has arms that partly encircle - lift - manipulate a complete Tug, Kick Stage and Payload. The estimates load would be 6(six) tons.</u>			
<u>Power to be electric hydraulic</u>			
DIMENSIONS (FT) <u>30'</u> L <u>10'</u> W <u>10'</u> H POWER _____ V _____ Hz _____ <u>0</u> KW			
WEIGHT (LBS) _____ FLUID REQUIREMENTS _____ PSIG _____ QUAN. _____			
ARTICLE OR ASSEMBLY SUPPORTED <u>Complete Tug, Kick Stage and Payload</u>			
VEHICLE INTERFACE _____			
FACILITY INTERFACE _____			
OTHER INTERFACING GSE _____			
MOBILITY REQUIREMENTS _____			
OPERATIONAL MODE: LOCAL <u>x</u> REMOTE _____ BOTH _____ DETAILS _____			
SOFTWARE REQUIREMENTS _____			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input checked="" type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR
REMARKS			
		TOTAL REQUIRED	

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Tug Erection Fixture</u>		ITEM NO. <u>H-032</u>		
REQUIREMENT SUMMARY <u>Raise Tug from Horiz. to Vertical</u>				
ITEM DESCRIPTION <u>A portable fixture (with tie-downs) consisting of a pivoting truss and ring assembly to which the aft-end of the Tug is fastened. The Tug is raised from horizontal to vertical position with a crane hook on the forward end.</u>				
DIMENSIONS (FT) <u>x</u> L <u>x</u> W <u>x</u> H POWER <u>None</u> V <u>  </u> Hz <u>0</u> KW				
WEIGHT (LBS) <u>x</u> FLUID REQUIREMENTS <u>None</u> PSIG <u>  </u> QUAN. <u>  </u>				
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug</u>				
VEHICLE INTERFACE <u>Aft truss</u>				
FACILITY INTERFACE <u>Tie-down points, crane.</u>				
OTHER INTERFACING GSE <u>  </u>				
MOBILITY REQUIREMENTS <u>Portable</u>				
OPERATIONAL MODE: LOCAL <u>x</u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>				
SOFTWARE REQUIREMENTS <u>N/A</u>				
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:		
NEW <input checked="" type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY	
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR	ETR
REMARKS				
TOTAL REQUIRED				

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Aft Umbilical Servicing Unit</u>		ITEM NO. <u>P-001</u>		
REQUIREMENT SUMMARY <u>Safely dispose of residual LH<sub>2</sub> in Tug tanks. Portable, self-propelled unit, capable of providing purge gas.</u>				
ITEM DESCRIPTION <u>Self propelled wheeled unit used on the runway to deservice the Tug LH<sub>2</sub> tank after an abort flight landing. Unit would provide remote connected interface to the orbiter aft umbilical, a burn stack and a supply of purge gas.</u>				
DIMENSIONS (FT) <u>50</u> L <u>12</u> W <u>20</u> H POWER <u>    </u> V <u>    </u> Hz <u>0</u> KW				
WEIGHT (LBS) <u>    </u> FLUID REQUIREMENTS <u>GH<sub>2</sub></u> PSIG <u>    </u> QUAN. <u>    </u>				
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug</u>				
VEHICLE INTERFACE <u>Orbiter aft umbilical plate</u>				
FACILITY INTERFACE <u>    </u>				
OTHER INTERFACING GSE <u>    </u>				
MOBILITY REQUIREMENTS <u>Over-the-road, self-powered</u>				
OPERATIONAL MODE: LOCAL <u>x</u> REMOTE <u>    </u> BOTH <u>    </u> DETAILS <u>    </u>				
SOFTWARE REQUIREMENTS <u>N/A</u>				
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:		
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY	
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR	ETR
REMARKS		1.8, 1.9, 1.11, 1.12,	1	2
		TOTAL REQUIRED	1	2

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Fuel Cell GN<sub>2</sub> Purge Unit</u>		ITEM NO. <u>P-002</u>	
REQUIREMENT SUMMARY <u>Purge the fuel cell hydrogen and oxygen tanks through the fuel cell vents, and to drain and purge the FC water system.</u>			
ITEM DESCRIPTION <u>The Fuel Cell Purge Unit is a portable regulated GN<sub>2</sub> supply with hoses, disconnects, and a water holding tank.</u>			
DIMENSIONS (FT) <u>    </u> L <u>    </u> W <u>    </u> H		POWER <u>N/A</u> V <u>    </u> Hz <u>0</u> KW	
WEIGHT (LBS) <u>    </u>		FLUID REQUIREMENTS <u>GN<sub>2</sub></u> PSIG <u>    </u> QUAN. <u>    </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug Fuel Cell</u>			
VEHICLE INTERFACE <u>    </u>			
FACILITY INTERFACE <u>    </u>			
OTHER INTERFACING GSE <u>    </u>			
MOBILITY REQUIREMENTS <u>Capable of hand maneuvering</u>			
OPERATIONAL MODE: LOCAL <input checked="" type="checkbox"/> REMOTE <u>    </u> BOTH <u>    </u> DETAILS <u>    </u>			
SOFTWARE REQUIREMENTS <u>    </u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			
REMARKS		QUANTITY	
		WTR ETR	
		1 2	
TOTAL REQUIRED		1 2	

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Fuel Cell Water Supply Unit</u>		ITEM NO. <u>P-003</u>	
REQUIREMENT SUMMARY <u>Charge the fuel cell cooling system and circulate water through the cooling system during load tests.</u>			
ITEM DESCRIPTION <u>Cart mounted supply of (TBS) water equipped with a pump.</u>			
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H		POWER <u>120</u> V <u>69</u> Hz <u>1</u> $\theta$ KW	
WEIGHT (LBS) <u>  </u>		FLUID REQUIREMENTS <u>H<sub>2</sub>O</u> PSIG <u>10-30</u> QUAN. <u>  </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug Fuel Cell</u>			
VEHICLE INTERFACE <u>  </u>			
FACILITY INTERFACE <u>  </u>			
OTHER INTERFACING GSE <u>  </u>			
MOBILITY REQUIREMENTS <u>  </u>			
OPERATIONAL MODE: LOCAL <input checked="" type="checkbox"/> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>  </u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			WTR
REMARKS			
Used during refurbishment of			
fuel cells			
TOTAL REQUIRED			2

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Fuel Cell <math>\text{GH}_2</math> Accumulator Charge Unit</u>		ITEM NO. <u>P-004</u>	
REQUIREMENT SUMMARY <u>Provide adjustable, regulated <math>\text{GH}_2</math> supply for fuel cell operation and charging.</u>			
ITEM DESCRIPTION <u>The fuel cell <math>\text{GH}_2</math> accumulator charge unit consists of cart, (TBS) psia <math>\text{GH}_2</math> supply container, piping, valves, instrumentation, flow control and flow totalizing systems.</u>			
DIMENSIONS (FT) _____ L _____ W _____ H _____ POWER <u>N/A</u> V _____ Hz _____ <u>0</u> KW _____			
WEIGHT (LBS) _____ FLUID REQUIREMENTS <u><math>\text{GN}_2</math></u> PSIG <u>20-2000</u> QUAN. _____			
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug fuel cell</u>			
VEHICLE INTERFACE _____			
FACILITY INTERFACE _____			
OTHER INTERFACING GSE _____			
MOBILITY REQUIREMENTS <u>Portable cost</u>			
OPERATIONAL MODE: LOCAL <u>x</u> REMOTE _____ BOTH _____ DETAILS _____			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR
REMARKS			1
Used during refurbishment			
of fuel cells			
TOTAL REQUIRED			1

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Fuel Cell CO<sub>2</sub> Accumulator Charge Unit</u>		ITEM NO. <u>P-005</u>	
REQUIREMENT SUMMARY <u>Provide adjustable regulated CO<sub>2</sub> supply for fuel cell operation and charging</u>			
ITEM DESCRIPTION <u>The fuel cell CO<sub>2</sub> accumulator charge unit consists of cart (TBS) psia CO<sub>2</sub> supply container, piping, valves, instrumentation, flow control and flow control totalizing systems</u>			
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H <u>  </u> POWER <u>N/A</u> V <u>  </u> Hz <u>  </u> <u>0</u> KW			
WEIGHT (LBS) <u>  </u> FLUID REQUIREMENTS <u>CO<sub>2</sub></u> PSIG <u>200-2000</u> QUAN. <u>  </u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug fuel cell</u>			
SERVICE INTERFACE <u>  </u>			
UTILITY INTERFACE <u>  </u>			
OTHER INTERFACING GSE <u>  </u>			
MOBILITY REQUIREMENTS <u>Portable Cart</u>			
OPERATIONAL MODE: LOCAL <u>x</u> REMOTE <u>  </u> BOTH <u>x</u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR
REMARKS			
Used for refurbishment of			
fuel cells			
TOTAL REQUIRED			1

NAME <u>Engine Alignment Kit</u>		ITEM NO. <u>P-006</u>	
REQUIREMENT SUMMARY <u>Align engine with Tug</u>			
ITEM DESCRIPTION <u>Kit containing dial indicators, throat plugs, nozzle exit plane spider device, shims and mounting hardware</u>			
DIMENSIONS (FT) _____ L _____ W _____ H _____	POWER <u>N/A</u> V _____ Hz _____	<u>0</u> KW	
WEIGHT (LBS) _____	FLUID REQUIREMENTS <u>N/A</u>	PSIG _____	QUAN. _____
ARTICLE OR ASSEMBLY SUPPORTED <u>N/A</u>			
VEHICLE INTERFACE <u>Tug Engine</u>			
FACILITY INTERFACE <u>N/A</u>			
OTHER INTERFACING GSE <u>N/A</u>			
MOBILITY REQUIREMENTS <u>Carry near kit</u>			
OPERATIONAL MODE: LOCAL <input checked="" type="checkbox"/> REMOTE _____ BOTH _____ DETAILS _____			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR
REMARKS		<u>4.18, 2.12</u>	<u>2</u>
		TOTAL REQUIRED	<u>2</u>



## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Tug Engine Actuator Servicing Kit</u>		ITEM NO. <u>P-007</u>	
REQUIREMENT SUMMARY <u>Special tools to permit actuator replacement, adjustment and engine support</u>			
ITEM DESCRIPTION <u>Kits containing stand-offs, gauging tools, adapter engine supports and wrenches necessary to service, remove and install the engine actuators.</u>			
DIMENSIONS (FT) <u>      </u> L <u>      </u> W <u>      </u> H POWER <u>N/A</u> V <u>      </u> Hz <u>0</u> KW			
WEIGHT (LBS) <u>      </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u>      </u> QUAN. <u>      </u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug Engine</u>			
VEHICLE INTERFACE <u>Engine actuator attach points</u>			
FACILITY INTERFACE <u>N/A</u>			
OTHER INTERFACING GSE <u>N/A</u>			
MOBILITY REQUIREMENTS <u>Carry near equipment</u>			
OPERATIONAL MODE: LOCAL <u>x</u> REMOTE <u>      </u> BOTH <u>      </u> DETAILS <u>      </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			WTR ETR
REMARKS			
<u>Used for engine actuator</u>			
<u>maintenance</u>			
TOTAL REQUIRED			2

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Alignment Kit</u>		ITEM NO. <u>P-008</u>	
REQUIREMENT SUMMARY <u>Tug - S/C, Deployment Adapter - Tug and Tug G&amp;W</u> <u>Package - Tug Alignment</u>			
ITEM DESCRIPTION <u>The alignment kit consists of optical targets, clinometers, attachment hardware, measuring equipment and associated optical instruments and fixtures to align payload elements.</u>			
DIMENSIONS (FT) L <u>    </u> W <u>    </u> H <u>    </u> POWER <u>N/A</u> V <u>    </u> Hz <u>0</u> KW <u>    </u>			
WEIGHT (LBS) <u>    </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u>    </u> QUAN. <u>    </u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug, kick stage, S/C and deployment adapter</u>			
VEHICLE INTERFACE <u>Alignment fixture attachment points</u>			
FACILITY INTERFACE <u>N/A</u>			
OTHER INTERFACING GSE <u>N/A</u>			
MOBILITY REQUIREMENTS <u>N/A</u>			
OPERATIONAL MODE: LOCAL <input checked="" type="checkbox"/> REMOTE <input type="checkbox"/> BOTH <input type="checkbox"/> DETAILS <input type="checkbox"/>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR
REMARKS		4.18, 5.1	2
		TOTAL REQUIRED	2

# TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Insulation Purge and Metering Unit</u>		ITEM NO. <u>P-009</u>	
REQUIREMENT SUMMARY <u>Supply and measure Tug insulation purge gas</u>			
ITEM DESCRIPTION <u>Portable unit that connects to facility gas (He) supply and provides a regulated flow to the purge bag. Provide measuring device to measure the efficient gas flow from the purge bag and determine the moisture content of the effluent.</u>			
DIMENSIONS (FT) <u>5</u> L <u>3</u> W <u>4</u> H		POWER <u>N/A</u> V <u>  </u> Hz <u>0</u> KW	
WEIGHT (LBS) <u>  </u>		FLUID REQUIREMENTS <u>GHe</u> PSIG <u>  </u> QUAN. <u>  </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug Purge Bag</u>			
VEHICLE INTERFACE <u>Purge Bag Inlet</u>			
FACILITY INTERFACE <u>He Supply</u>			
OTHER INTERFACING GSE <u>  </u>			
MOBILITY REQUIREMENTS <u>Portable-Wheel Mounted</u>			
OPERATIONAL MODE: LOCAL <input checked="" type="checkbox"/> REMOTE <input type="checkbox"/> BOTH <input type="checkbox"/> DETAILS <input type="checkbox"/>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			
REMARKS		QUANTITY	
		WTR ETR	
		1 2	
TOTAL REQUIRED		1 2	

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Propellant Supply and Transfer Unit</u>		ITEM NO. <u>P-010</u>	
REQUIREMENT SUMMARY <u>Provide portable LH<sub>2</sub> and LO<sub>2</sub> capability for fuel cell checkout.</u>			
ITEM DESCRIPTION <u>The supply and transfer set consists of LH<sub>2</sub> and LO<sub>2</sub> dewars, pressurization system, transfer liner, adapter and a facility vent line.</u>			
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H <u>  </u> POWER <u>110</u> V <u>60</u> Hz <u>1</u> <u>0</u> KW			
WEIGHT (LBS) <u>  </u> FLUID REQUIREMENTS <u>LH<sub>2</sub>, LO<sub>2</sub></u> PSIG <u>  </u> QUAN. <u>  </u>			
<u>40 lbs LH<sub>2</sub>, 40 lbs LO<sub>2</sub></u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>Fuel Cell Checkout</u>			
VEHICLE INTERFACE <u>N/A</u>			
FACILITY INTERFACE <u>Utility Power Receptable, LH<sub>2</sub> Vent, LO<sub>2</sub> Vent</u>			
OTHER INTERFACING GSE <u>N/A</u>			
MOBILITY REQUIREMENTS <u>Portable Cart</u>			
OPERATIONAL MODE: LOCAL <input checked="" type="checkbox"/> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			
REMARKS		QUANTITY	
		WTR ETR	
<u>Used for fuel cell refurbishment</u>			
<u>and off-line checkout</u>			
TOTAL REQUIRED		2	

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>APS Propellant Control Set</u>		ITEM NO. <u>P-011</u>		
REQUIREMENT SUMMARY <u>Support APS Leak and Functional Checks and Purge Operations</u>				
ITEM DESCRIPTION <u>This unit is used to perform APS propellant and pressurization system leak and functional tests. It will provide regulated pressure to the APS interface to leak check the system, and regulated power for valve actuation. The unit contains valves, regulators, gages, inter-connecting plumbing, conditioning, regulating and control equipment.</u>				
DIMENSIONS (FT) <u>    </u> L <u>    </u> W <u>    </u> H POWER <u>110</u> V <u>60</u> Hz <u>1</u> <u>0</u> KW				
WEIGHT (LBS) <u>    </u> FLUID REQUIREMENTS <u>GN<sub>2</sub></u> PSIG <u>500</u> QUAN. <u>    </u>				
ARTICLE OR ASSEMBLY SUPPORTED <u>APS flight system</u>				
VEHICLE INTERFACE <u>APS pressurization umbilical</u>				
FACILITY INTERFACE <u>Facility power, facility gas</u>				
OTHER INTERFACING GSE <u>LPS, E-001</u>				
MOBILITY REQUIREMENTS <u>Move from TPF maintenance and checkout area to storable propellant loading area</u>				
OPERATIONAL MODE: LOCAL <u>x</u> REMOTE <u>    </u> BOTH <u>    </u> DETAILS <u>    </u>				
SOFTWARE REQUIREMENTS <u>N/A</u>				
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:		
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY	
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR	ETR
REMARKS		<u>1.6, 2.1, 2.11, 4.6,</u>		
		<u>4.41, 4.42, 5.10, 5.11</u>	<u>1</u>	<u>2</u>
		TOTAL REQUIRED	<u>1</u>	<u>2</u>

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>APS Propellant Supply and Transfer Unit</u>		ITEM NO. <u>P-012</u>	
REQUIREMENT SUMMARY <u>Unload and drain</u>			
ITEM DESCRIPTION <u>This unit is used to unload hydrazine aboard the Tug APS storage tank. The unit contains pump, valves, regulators, flow measuring/control devices.</u>			
DIMENSIONS (FT) <u>    </u> L <u>    </u> W <u>    </u> H POWER <u>220</u> V <u>60</u> Hz <u>3</u> <u>0</u> KW			
WEIGHT (LBS) <u>    </u> FLUID REQUIREMENTS <u>GN<sub>2</sub></u> PSIG <u>    </u> QUAN. <u>    </u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>APS flight system</u>			
VEHICLE INTERFACE <u>APS fill and drain line umbilical, electrical umbilical</u>			
FACILITY INTERFACE <u>Facility pressure, facility power</u>			
OTHER INTERFACING GSE <u>LPS, E-001</u>			
MOBILITY REQUIREMENTS <u>Over the road</u>			
OPERATIONAL MODE: LOCAL <u>    </u> REMOTE <u>    </u> BOTH <u>x</u> DETAILS <u>    </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR
REMARKS			
<u>Contingency, unloading of APS</u>			
<u>hydrazine</u>			
TOTAL REQUIRED		<u>1</u>	<u>2</u>

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Preservation Kit</u>		ITEM NO. <u>P-013</u>	
REQUIREMENT SUMMARY <u>Permit free breathing of Tug APS propellant tanks during shipment and storage.</u>			
ITEM DESCRIPTION <u>The preservation kit consists of nozzle closures, interface fittings, desiccants and hydrazine absorber.</u>			
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H		POWER <u>N/A</u> V <u>  </u> Hz <u>  </u> KW	
WEIGHT (LBS) <u>  </u>		FLUID REQUIREMENTS <u>N/A</u> PSIG <u>  </u> QUAN. <u>  </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>APS propellant tanks</u>			
VEHICLE INTERFACE <u>APS fill and drain lines</u>			
FACILITY INTERFACE <u>N/A</u>			
OTHER INTERFACING GSE <u>N/A</u>			
MOBILITY REQUIREMENTS <u>N/A</u>			
OPERATIONAL MODE: LOCAL <u>x</u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			
REMARKS		QUANTITY	
		WTR ETR	
Used during shipment and storage			
TOTAL REQUIRED		2	

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Vacuum Pump and Gauge Unit</u>		ITEM NO. <u>P-014</u>	
REQUIREMENT SUMMARY <u>Provide vacuum source for instrumentation test and checkout and for evacuating vacuum insulated cryogenic lines.</u>			
ITEM DESCRIPTION <u>The unit consists of a vacuum pump, associated valves and piping, a sensor and associated electronics.</u>			
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H		POWER <u>220</u> V <u>60</u> Hz <u>3</u> <u>0</u> KW	
WEIGHT (LBS) <u>  </u>		FLUID REQUIREMENTS <u>  </u> PSIG <u>  </u> QUAN. <u>  </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>Propulsion fill lines</u>			
VEHICLE INTERFACE <u>Vacuum jacketed lines</u>			
FACILITY INTERFACE <u>Facility power</u>			
OTHER INTERFACING GSE <u>  </u>			
MOBILITY REQUIREMENTS <u>Portable cart</u>			
OPERATIONAL MODE: LOCAL <input checked="" type="checkbox"/> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>  </u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>			WTR ETR
REMARKS		2.12	2
		TOTAL REQUIRED	2



## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Hydraulic Servicer</u>		ITEM NO. <u>P-015</u>		
REQUIREMENT SUMMARY <u>Service hydraulic system</u>				
ITEM DESCRIPTION <u>The servicer contains a hydraulic pump, reservoir,</u>				
<u>control valves, relief valves, gauges, filters, hoses, and associated</u>				
<u>plumbing and interface connectors.</u>				
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H POWER <u>220</u> V <u>60</u> Hz <u>3</u> <u>Ø</u> KW				
WEIGHT (LBS) <u>  </u> FLUID REQUIREMENTS <u>Hyd fluid</u> PSIG <u>  </u> QUAN. <u>  </u>				
ARTICLE OR ASSEMBLY SUPPORTED <u>hydraulic system</u>				
VEHICLE INTERFACE <u>hydraulic system</u>				
FACILITY INTERFACE <u>facility power</u>				
OTHER INTERFACING GSE <u>N/A</u>				
MOBILITY REQUIREMENTS <u>N/A</u>				
OPERATIONAL MODE: LOCAL <input checked="" type="checkbox"/> REMOTE <input type="checkbox"/> BOTH <input type="checkbox"/> DETAILS <input type="checkbox"/>				
SOFTWARE REQUIREMENTS <u>  </u>				
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:		
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY	
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR	ETR
REMARKS				
<u>Used for hydraulic system</u>				
<u>servicing required</u>				
TOTAL REQUIRED			2	

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Pressurization Control Set</u>		ITEM NO. <u>P-016</u>	
REQUIREMENT SUMMARY <u>Provide, measure and control gas pressure to Tug</u>			
ITEM DESCRIPTION <u>This unit provides the gas pressure supply and regulation and power regulation and control to perform leak and functional checkout on the Tug pressurization/main propellant/main propulsion systems. The set contains valves, regulators, gages, interconnecting plumbing, power conditioning/regulation and control.</u>			
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H <u>  </u> POWER <u>110</u> V <u>60</u> Hz <u>1</u> <u>0</u> KW			
WEIGHT (LBS) <u>  </u> FLUID REQUIREMENTS <u>GHe, GN<sub>2</sub></u> PSIG <u>  </u> QUAN. <u>  </u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>Flight systems</u>			
VEHICLE INTERFACE <u>Pressurization and Vent Umbilical</u>			
FACILITY INTERFACE <u>Facility pressure, facility power</u>			
OTHER INTERFACING GSE <u>LPS, E-001</u>			
MOBILITY REQUIREMENTS <u>N/A</u>			
OPERATIONAL MODE: LOCAL <input checked="" type="checkbox"/> REMOTE <input type="checkbox"/> BOTH <input type="checkbox"/> DETAILS <input type="checkbox"/>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>		QUANTITY	
REMARKS		WTR	ETR
1.6, 1.15, 2.1, 2.2, 2.3, 2.5,			
2.11, 2.17, 2.18, 4.6, 4.7, 4.8,			
4.10, 4.16, 4.24, 5.10		1	2
TOTAL REQUIRED		1	2

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Decontamination Unit, APS</u>		ITEM NO. <u>P-017</u>		
REQUIREMENT SUMMARY <u>Decontaminate hydrazine contaminated tanks and components</u>				
ITEM DESCRIPTION <u>The unit contains valves, regulators, heaters, decontamination fluid system, and associated plumbing and control system to purge and decontaminate contaminated systems in-place on the Tug to a safe level.</u>				
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H <u>  </u> POWER <u>N/A</u> V <u>  </u> Hz <u>  </u> <u>0</u> KW				
WEIGHT (LBS) <u>  </u> FLUID REQUIREMENTS <u>Cleaning fluid</u> PSIG <u>  </u> QUAN. <u>  </u>				
ARTICLE OR ASSEMBLY SUPPORTED <u>APS</u>				
VEHICLE INTERFACE <u>APS fill, drain and vent</u>				
FACILITY INTERFACE <u>Facility power, GN<sub>2</sub></u>				
OTHER INTERFACING GSE <u>  </u>				
MOBILITY REQUIREMENTS <u>Portable unit</u>				
OPERATIONAL MODE: LOCAL <u>x</u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>				
SOFTWARE REQUIREMENTS <u>N/A</u>				
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:		
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY	
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR	ETR
REMARKS				
<u>Used for maintenance of APS</u>				
<u>components</u>				
TOTAL REQUIRED			2	

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Vacuum Pump and Gauge Unit - APS</u>		ITEM NO. <u>P-018</u>	
REQUIREMENT SUMMARY <u>Provide vacuum source for evacuating APS tank and</u> <u>line prior to loading.</u>			
ITEM DESCRIPTION <u>The unit consists of a vacuum pump, associated valves</u> <u>and piping, a sensor and associated electronics.</u>			
DIMENSIONS (Ft) <u>  </u> L <u>  </u> W <u>  </u> H <u>  </u>		POWER <u>220</u> V <u>60</u> Hz <u>3</u> <u>0</u> KW	
WEIGHT (LBS) <u>  </u>		FLUID REQUIREMENTS <u>  </u> PSIG <u>  </u> QUAN. <u>  </u>	
ARTICLE OR ASSEMBLY SUPPORTED <u>APS subsystem</u>			
VEHICLE INTERFACE <u>APS lines</u>			
FACILITY INTERFACE <u>Facility power</u>			
OTHER INTERFACING GSE <u>  </u>			
MOBILITY REQUIREMENTS <u>N/A</u>			
OPERATIONAL MODE: LOCAL <u>x</u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>  </u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>		QUANTITY	
REMARKS		WTR	ETR
		1	2
TOTAL REQUIRED		1	2

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Thermal Control Servicing Set</u>		ITEM NO. <u>P-019</u>	
REQUIREMENT SUMMARY <u>Service active Thermal Control System</u>			
ITEM DESCRIPTION <u>The servicer contains a pump, reservoir control valves, relief valves, gauges, filter, hoses and associated plumbing and interface connectors.</u>			
DIMENSIONS (FT) <u>    </u> L <u>    </u> W <u>    </u> H POWER <u>220</u> V <u>60</u> Hz <u>3</u> <u>0</u> KW			
WEIGHT (LBS) <u>            </u> FLUID REQUIREMENTS <u>            </u> PSIG <u>            </u> QUAN. <u>            </u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>Active thermal control system</u>			
VEHICLE INTERFACE <u>                                    </u>			
FACILITY INTERFACE <u>Facility power</u>			
OTHER INTERFACING GSE <u>N/A</u>			
MOBILITY REQUIREMENTS <u>Portable wheel mounted</u>			
OPERATIONAL MODE: LOCAL <u>X</u> REMOTE <u>            </u> BOTH <u>            </u> DETAILS <u>            </u>			
SOFTWARE REQUIREMENTS <u>N/A</u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR
REMARKS		2.12	2
TOTAL REQUIRED			2

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Hot GN<sub>2</sub> Purge Unit</u>		ITEM NO. <u>P-020</u>		
REQUIREMENT SUMMARY <u>Supply hot GN<sub>2</sub> for MLI purging</u>				
ITEM DESCRIPTION <u>Portable unit that provides a regulated flow to the purge bag. Provide measuring device to measure the gas flow from the purge bag and determine moisture content. Provide heater capability to heat N<sub>2</sub> to 580°F (120°F)</u>				
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H <u>  </u> POWER <u>220</u> V <u>60</u> Hz <u>3</u> <u>0</u> KW				
WEIGHT (LBS) <u>  </u> FLUID REQUIREMENTS <u>GN<sub>2</sub></u> PSIG <u>  </u> QUAN. <u>  </u>				
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug purge bag</u>				
VEHICLE INTERFACE <u>Purge bag inlet</u>				
FACILITY INTERFACE <u>GN<sub>2</sub> supply</u>				
OTHER INTERFACING GSE <u>  </u>				
MOBILITY REQUIREMENTS <u>Portable wheel mounted</u>				
OPERATIONAL MODE: LOCAL <u>x</u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>				
SOFTWARE REQUIREMENTS <u>N/A</u>				
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:		
NEW <input type="checkbox"/>	EXISTING <input type="checkbox"/>	FUNCTION BLOCK NO.	QUANTITY	
MODIFIED <input type="checkbox"/>	COMMERCIAL <input type="checkbox"/>		WTR	ETR
REMARKS		4.23		2
TOTAL REQUIRED			2	

## TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Ultrasonic Scan Unit</u>		ITEM NO. <u>S-001</u>	
REQUIREMENT SUMMARY <u>Inspection of aluminum to honeycomb core bond</u>			
ITEM DESCRIPTION <u>Low frequency device employing vibration generating sensor</u> <u>and logic for analyses of harmonic and/or frequency display.</u>			
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H <u>  </u> POWER <u>120</u> V <u>  </u> Hz <u>  </u> <u>0</u> KW			
WEIGHT (LBS) <u>  </u> FLUID REQUIREMENTS <u>  </u> PSIG <u>  </u> QUAN. <u>  </u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug structure</u>			
VEHICLE INTERFACE <u>Surface to be scanned</u>			
FACILITY INTERFACE <u>  </u>			
OTHER INTERFACING GSE <u>  </u>			
MOBILITY REQUIREMENTS <u>Portable</u>			
OPERATIONAL MODE: LOCAL <u>x</u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>  </u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>		QUANTITY	
REMARKS		WTR	ETR
			2
TOTAL REQUIRED			2

# TUG GSE REQUIREMENTS SPECIFICATION DATA SHEET

NAME <u>Radiography Unit</u>		ITEM NO. <u>S-002</u>	
REQUIREMENT SUMMARY <u>Examination of Tug structure for internal flows, discontinuities, cracks, and failures</u>			
ITEM DESCRIPTION			
DIMENSIONS (FT) <u>  </u> L <u>  </u> W <u>  </u> H <u>  </u> POWER <u>220</u> V <u>60</u> Hz <u>0</u> KW			
WEIGHT (LBS) <u>  </u> FLUID REQUIREMENTS <u>N/A</u> PSIG <u>  </u> QUAN. <u>  </u>			
ARTICLE OR ASSEMBLY SUPPORTED <u>Tug structure</u>			
VEHICLE INTERFACE <u>Surface of all structure to be examined</u>			
FACILITY INTERFACE <u>  </u>			
OTHER INTERFACING GSE <u>  </u>			
MOBILITY REQUIREMENTS <u>  </u>			
OPERATIONAL MODE: LOCAL <u>  </u> REMOTE <u>  </u> BOTH <u>  </u> DETAILS <u>  </u>			
SOFTWARE REQUIREMENTS <u>  </u>			
EQUIPMENT SOURCE:		EQUIPMENT ALLOCATION:	
NEW <input type="checkbox"/> EXISTING <input type="checkbox"/>		FUNCTION BLOCK NO.	
MODIFIED <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>		QUANTITY	
REMARKS		WTR	ETR
		2.12	2
TOTAL REQUIRED			2



## TUG FACILITY REQUIREMENTS SPECIFICATION DATA SHEET

The Tug Facility Requirements Specification Data Sheet is prepared to provide requirements data for launch site operational facility planning.\* This data will provide the basic information from which decisions can be made to utilize existing facilities, modify existing facilities, or build new facilities to support Tug activities. This sheet identifies the facility, the launch site, the functions performed in the facility, and the functional flow block number as follows:

**FACILITY:** Identifying name of the facility or major area at the launch site.

**LOCATION:** Identification of a specific area, i.e., airlock, checkout, propellant loading, etc., required within the facility identified above.

**FUNCTION:** Description of the activities performed in the facility during major blocks of Tug turn-around activities in the different locations.

**FUNCTION BLOCK NO.:** A cross reference to the Space Tug Functional Flow Diagram block numbers<sup>†</sup> applicable to the particular location identified.

**CHARACTERISTICS:** Identification and definition of Tug and/or Tug/GSE footprint requirements, ceiling height requirements, cleanliness level requirements, security requirements, requirement for LPS station/interfaces, and any commodities/consumables required.

\*Based on the functions defined in the Tug Functional Flow Diagram, subplan A, Volume II, Part I and the Tug Function Description Data Sheets in Appendix A.

<sup>†</sup>Reference: subplan A, Volume II, Part I.

REQUIREMENTS/DESCRIPTION: A narrative description of facility requirements including door width, height, hook height, bridge crane capacity, test area support requirements, special ventilation requirements, etc.

## TUG FACILITY REQUIREMENT SPECIFICATION DATA SHEET

[illegible]

## TUG FACILITY REQUIREMENT SPECIFICATION DATA SHEET

[illegible]

## TUG FACILITY REQUIREMENT SPECIFICATION DATA SHEET

FACILITY: Tug Processing Facility		LOCATION: Airlock
FUNCTION: Receive inspect, clean, damage inspection, Tug safing.		FUNCTION BLOCK NO: 1.4 - 1.7, 1.13, 1.14, 1.15, 2.1 - 2.9, 2.13, 2.14, 4.3 - 4.11, 4.31 - 4.36
CHARACTERISTICS: FLOOR 70 ft L 50 ft W 3500 SQ. FT. 95 ft CEILING HEIGHT		
CLEANLINESS LEVEL REQUIRED N/A SECURITY REQUIRED N/A		
LPS TERMINAL REQUIRED YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> COMMODITIES Utility power receptacle GN <sub>2</sub> , H <sub>2</sub> , Cleaning Chemical		
REQUIREMENTS/DESCRIPTION 1. Access Door: Clear width 25 ft., clear height 85 ft. 2. Overhead bridge crane: 8 ton minimum capacity, minimum hook height 85 ft. above floor, minimum horizontal travel TBD. Single speed lift with inching capability at any position. 3. Purge and vent: a. H <sub>2</sub> - 3 inch vent line to remote burnoff unit or pond; H <sub>2</sub> purge supply; b. O <sub>2</sub> - 3 inch vent line to remote GOX safe area; GN <sub>2</sub> purge supply; c. Hydrazine - 3 inch vent line to remote hydrazine safe area; GN <sub>2</sub> purge supply. 4. Personnel safety and hazardous area requirements: a. Hazard gas detection system; b. Fire protection and standby equipment; c. Safety shower; d. Static electricity bonding and grounding set; e. Positive ventilation system; f. Lightning protection; g. Emergency egress.		

## TUG FACILITY REQUIREMENT SPECIFICATION DATA SHEET

FACILITY: Tug Processing Facility		LOCATION: Tug Maintenance and Checkout Area	
FUNCTION: Tug refurbish, checkout, and buildup for		FUNCTION BLOCK NO:	
mission. Mate spacecraft to Tug and checkout.		2.10, 2.11, 2.12, 3.1, 4.12,	
		4.13, 4.16 - 4.29, 5.1 - 5.9,	
		5.13, 5.21	
CHARACTERISTICS:			
FLOOR	35 ft	L 35 ft	W 1325 SQ. FT. 95 ft CEILING HEIGHT
CLEANLINESS LEVEL REQUIRED	100K	SECURITY REQUIRED	as required by S/C
LPS TERMINAL REQUIRED	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	COMMODITIES	Utility power receptacle for
C/O equipment 120V 60 Hz Single Phase, 5 KVA; $\text{GH}_4$ , $\text{GN}_2$ , Utility Compressed Air,			
Cooling Air for Tug electronics			
REQUIREMENTS/DESCRIPTION			
1. Overhead crane: 8 ton minimum capacity, minimum hook height 85 ft above			
floor, minimum horizontal travel TBD, single speed lift with inching			
capability at any position.			
2. OIS Communications			
3. Two bays required			
4. Parasitic Antenna			
5. Tempest compatible			
6. Propellant vent lines, pneumatic supply, drains, washdown hoses,			
eye washes.			

## TUG FACILITY REQUIREMENT SPECIFICATION DATA SHEET

[illegible]

## TUG FACILITY REQUIREMENT SPECIFICATION DATA SHEET

[illegible]



# TUG FACILITY REQUIREMENT SPECIFICATION DATA SHEET

FACILITY: Tug Processing Facility	LOCATION: Storable Propellant Loading Area
FUNCTION: Load Tug APS Propellants and Partial Pressurant Load	FUNCTION BLOCK NO:  5.10, 5.11, 5.12
CHARACTERISTICS:	
FLOOR 25 ft L 25 ft W 625 SQ. FT. 95 ft. CEILING HEIGHT	
CLEANLINESS LEVEL REQUIRED 100K	SECURITY REQUIRED as required by S/C
LPS TERMINAL REQUIRED YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	COMMODITIES 350 lbs hydrazine, CH <sub>4</sub> , utility power receptacle, GN <sub>2</sub>
REQUIREMENTS/DESCRIPTION	
1. Access door: clear width 25 ft, clear height 85 ft.	
2. Personnel safety and hazard area requirements: a. hazard gas detection system; b. fire protection and standby equipment; c. safety shower; d. static electricity bonding and grounding set; e. positive ventilation system; f. lightning protection; g. emergency egress.	
3. OIS communications.	

## TUG FACILITY REQUIREMENT SPECIFICATION DATA SHEET

FACILITY: Spacecraft Processing Facility		LOCATION: Storable Propellant Loading Area
FUNCTION: Load Tug APS propellants and partial pressurant load.		FUNCTION BLOCK NO: 5.10, 5.11, 5.12
CHARACTERISTICS: FLOOR 25 ft L 25 ft W 625 SQ. FT. 95 ft CEILING HEIGHT		
CLEANLINESS LEVEL REQUIRED 100K SECURITY REQUIRED as required by S/C		
LPS TERMINAL REQUIRED YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> COMMODITIES 350 lbs hydrazine, $\text{GH}_4$ , utility power receptacle, $\text{GN}_2$		
REQUIREMENTS/DESCRIPTION 1. Access door: clear width 25 ft, clear height 85 ft. 2. Personnel safety and hazard area requirements: a. hazard gas detection system; b. fire protection and standby equipment; c. safety shower; d. static electricity bonding and grounding set; e. positive ventilation system; f. lightning protection; g. emergency egress. 3. OIS communications		

## TUG FACILITY REQUIREMENT SPECIFICATION DATA SHEET

[illegible]

## TUG FACILITY REQUIREMENT SPECIFICATION DATA SHEET

[illegible]

## TUG FACILITY REQUIREMENT SPECIFICATION DATA SHEET

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## TUG FACILITY REQUIREMENT SPECIFICATION DATA SHEET

[illegible]

## TUG FACILITY REQUIREMENT SPECIFICATION DATA SHEET

[illegible]

# TUG FACILITY REQUIREMENT SPECIFICATION DATA SHEET

[illegible]



## TUG FACILITY REQUIREMENT SPECIFICATION DATA SHEET

[illegible]

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## TUG FACILITY REQUIREMENT SPECIFICATION DATA SHEET

[illegible]

## TUG FACILITY REQUIREMENT SPECIFICATION DATA SHEET

[illegible]

[illegible]

## TUG FACILITY REQUIREMENT SPECIFICATION DATA SHEET

[illegible]

## TUG FACILITY REQUIREMENT SPECIFICATION DATA SHEET

FACILITY: Launch Complex		LOCATION: Payload Changeout Room
FUNCTION: Payload transfer (canister to PCR), buildup, and		FUNCTION BLOCK NO:
checkout, transfer (PCR to orbiter bay)		5.2, 5.4, 5.5, 5.6, 5.8, 5.19,
		5.20, 5.21, 6.3 - 6.10, 7.1,
		7.2, 7.3
CHARACTERISTICS:		
FLOOR 50 ft L 50 ft W 2500 SQ. FT. 80 ft CEILING HEIGHT		
CLEANLINESS LEVEL REQUIRED 100K SECURITY REQUIRED as required by S/C		
LPS TERMINAL REQUIRED YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> COMMODITIES Cooling air for Tug		
electronics, utility power receptacle.		
REQUIREMENTS/DESCRIPTION		
1. Retractable clean room to mate with orbiter bay and maintain 100K during		
extend/retract and orbiter bay operation.		
2. OIS communications		
3. Staging area at base of PCR		
4. Overhead crane: 8 ton minimum capacity, hook height 70 ft minimum, single		
speed with inching capability.		
5. Personnel and freight elevator		
6. Lightning protection		
7. Payload handling device		
a. Holding fixture for buildup and checkout of payload		
b. 3 degree of freedom for payload movement from PCR to orbiter bay		
8. Mobile 8 ton crane		
9. Tempest compatible.		

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## TUG FACILITY REQUIREMENT SPECIFICATION DATA SHEET

FACILITY: Launch Complex		LOCATION: LO <sub>2</sub> /LH <sub>2</sub> Interface Towers	
FUNCTION: Load Tug propellants and pressurants		FUNCTION BLOCK NO:	
		7.1, 7.2	
CHARACTERISTICS:			
FLOOR	N/A	L	N/A
W	N/A	SQ. FT.	N/A
CEILING HEIGHT			
CLEANLINESS LEVEL REQUIRED		N/A	
SECURITY REQUIRED		N/A	
LPS TERMINAL REQUIRED		YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>	
COMMODITIES		LH <sub>2</sub> , LO <sub>2</sub> , GH <sub>e</sub>	
REQUIREMENTS/DESCRIPTION			
1. The following services are required via the LH <sub>2</sub> /LO <sub>2</sub> interface towers to the payload disconnect panels on the orbiter.			
a. LO <sub>2</sub> fill and drain (main propellant tank and fuel cells)			
b. LH <sub>2</sub> fill and drain (main propellant tank and fuel cells)			
c. GH <sub>e</sub> fill and vent			
d. LH <sub>2</sub> tank vent			
e. LO <sub>2</sub> tank vent			
f. APS system vent			
g. Fuel cell vent			

## TUG FACILITY REQUIREMENT SPECIFICATION DATA SHEET

FACILITY:	Storage and Maintenance Bldg.
LOCATION:	TPF
FUNCTION:	Inspect, Clean Damage Inspection, Store Tug, Adapter, Sys. Hardware, Refurbish Area, Calibrate, Maintain GSE, Office and Crew Areas.
CHARACTERISTICS: FLOOR _____ L _____ W _____ SQ. FT. _____ CEILING HEIGHT _____ CLEANLINESS LEVEL REQUIRED _____ N/A SECURITY REQUIRED _____ LPS TERMINAL REQUIRED YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> COMMODITIES Facility Power, Utility Compressed Air, Overhead Crane.  REQUIREMENTS/DESCRIPTION 1. Access door clear width and height - 25'-0" 2. Overhead crane: capacity (TBD) min. hook height (TBD), horz. or long travel (TBD) Single speed lift with inching capability at any position. 3. Bonded storage for Tugs, adapters and system hardware storage racks, bins and shelves. 4. Personnel safety area requirements: a) fire protection and standby equipment; b) safety shower; c) static electric bonding and grounding set; d) positive ventilation system; e) lightning protection; f) emergency exits. 5. Office equipment, personnel lockers, etc.	



## SOFTWARE REQUIREMENTS DATA SHEET

A Software Requirements Data Sheet has been prepared for each Function Description Data Sheet operation that requires software support. These sheets provide the following summary data:

FUNCTION NO: The number for the block on the Space Tug Functional Flow Diagram.\*

FUNCTION TITLE: The title of the function block.

FUNCTION: Brief statement of function objective.

REQUIREMENTS/DESCRIPTION: Specific requirements requiring use or generation of ground software.

COMPUTER INTERFACE: The LPS interface with the controlled, monitored, or tested item.

INPUT DESCRIPTION: Keyed to the requirements/description section by number, this section lists all the inputs that the software needs to function in its predetermined manner.

OUTPUT DESCRIPTION: Also keyed to the requirements/description section by number, this section lists all the outputs from the computer that required software in the processing of the data or in the generation of outputs, i.e., commands, simulations, stimulations, etc.

SOFTWARE: Non-Recurring, Recurring: This section is an estimate of the operational permanence of the software. Systems that remain static in their changes will have non-recurring software. New systems, improvements, variations in payloads, changes in processing, could require new software for each test cycle.

\*Shown in subplan A, Volume II, Part I.

FUNCTION BLOCK NO: A cross reference to other similar software,  
i.e., power turn on sequences, CRT routines, etc., again keyed by  
number to the requirements/description.

USAGE: Applies to both WTR and ETR unless one block only is checked.

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 1.2	FUNCTIONS TITLE: Remove Spacecraft			
FUNCTION: Demate Spacecraft and Tug				
Ground assumes monitoring function				
REQUIREMENTS/DESCRIPTION				
(1) Continue data dump, D/L taping, and erase				
(2) Activate and control ground power				
(3) Compare parameters for safety and initiate corrective actions				
COMPUTER INTERFACE				
HIM, FEP				
INPUT DESCRIPTION		OUTPUT DESCRIPTION		
(1) Commands, Erasure Bits		(1) Data (mag tape), no data (erasure confirm)		
(2) Manual initiation		(2) Power up and transfer sequences		
(3) A/B parameters		(3) Sum status, exception report out of limits.		
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:		
		FUNCTION BLOCK NO.	USAGE	
			WTR	ETR

# SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 1.5	FUNCTIONS TITLE: Safe and Remove Expended Ordnance		
FUNCTION: Safe ordnance			
REQUIREMENTS/DESCRIPTION			
(1) Compare each ordnance device status against an expended state and identify fired squibs.			
(2) Remove power and verify power removed from initiators and ordnance firing buses.			
COMPUTER INTERFACE			
FEP			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) A/B parameters		(1) Data (strip chart), (A-N CRT), and (function panel)	
(2) Manual initiation		(2) Commands (bit pattern) data	
A/B parameters			
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO. 1.6	FUNCTIONS TITLE: Drain and Purge APS		
FUNCTION: Control the removal of all liquid from APS			
REQUIREMENTS/DESCRIPTION			
(1) Control A/B and GSE valves in a logical sequence			
(2) Assess APS condition			
COMPUTER INTERFACE			
FEP, HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Manual initiation		(1) A/B commands (bit patterns) and	
Valve status		GSE commands and conditioning in	
		a logical sequence	
(2) Liquid sensors		(2) Data (strip chart (trends), CRT,	
Particulate count		function panel)	
SOFTWARE		SOFTWARE ALLOCATION:	
<input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING			
		FUNCTION BLOCK NO.	USAGE
			WTR    ETR

# SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO:		FUNCTIONS TITLE:	
1.15		Vent Pressurants to Safe Level	
FUNCTION:			
Control venting and monitor tank pressures			
REQUIREMENTS/DESCRIPTION			
(1) Control airborne valves			
(2) Monitor pressures to safe level			
COMPUTER INTERFACE HIM, FEP			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Manual initiation		(1) Command generation	
		Safety controls interlock with	
		GSE connected micro switches and	
		overpressure transducers.	
(2) A/B and/or GSE pressures (analogs)		(2) Data (strip chart, CRT)	
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR   ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 2.1	FUNCTIONS TITLE: Leak Check Pressurization System		
FUNCTION: Monitor system pressures			
REQUIREMENTS/DESCRIPTION			
(1) Control GSE and A/B valves for loading and lockup			
(2) Monitor tank pressures			
COMPUTER INTERFACE			
HIM, FEP			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Manual initiation		(1) A/B commands (bit patterns)	
Valve status		GSE commands and conditioning	
		logic operations	
(2) Analogs and discretes		(2) Data (strip chart and CRT display)	
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

# SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 2.2		FUNCTIONS TITLE: Leak Check LO <sub>2</sub> Tank	
FUNCTION: Monitor tank pressures			
REQUIREMENTS/DESCRIPTION			
(1) Control airborne valves for a pressurization and lockup cycle			
(2) Contingency control GSE valves during a pressurization and lockup cycle			
(3) Monitor pressures			
(4) Vent gas following test			
COMPUTER INTERFACE			
FEB, HIM (GSE)			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Manual initiation		(1) A/B commands and logic operations	
A/B Valve status			
(2) Same initiation as (1) above GSE		(2) GSE commands and logic operations	
valve status		integrated with airborne	
(3) Analogs and discretes		(3) Data (strip chart and CRT) and	
		compare monitoring	
(4) Same as (1)			
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	
		USAGE	
		WTR	ETR



## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 2.3	FUNCTIONS TITLE: Leak Check LH <sub>2</sub> Tank			
FUNCTION: Verify LH <sub>2</sub> System Integrity - Monitor pressures				
REQUIREMENTS/DESCRIPTION				
(1) Control airborne valves for a pressurization and lockup cycle				
(2) Contingency control GSE valves for a pressurization and lockup cycle				
(3) Monitor pressures				
(4) Vent gas following the test				
COMPUTER INTERFACE FEP, HIM (GSE)				
INPUT DESCRIPTION		OUTPUT DESCRIPTION		
(1) Manual initiation		(1) A/B commands and logic operations		
Valve status				
(2) Same input as (1) above		(2) GSE commands and logic operations		
		integrated with airborne		
(3) Analog and discretes for pressures		(3) Data (strip chart and CRT)		
		Compare monitoring		
(4) Same as (1)				
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:		
		FUNCTION BLOCK NO.	USAGE	
			WTR	ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 2.4	FUNCTIONS TITLE: Service Fuel Cells and Reactant Leak Check		
FUNCTION: Control fuel cell valves for servicing and leak checking			
REQUIREMENTS/DESCRIPTION			
(1) Control airborne and GSE fuel cell valves to remove fuel cell moisture			
(2) Control fuel cell valves (leak check)			
(3) Control GSE valves, if required, to pressurize fuel cells			
(4) Monitor pressures			
(5) Vent gas following the test			
COMPUTER INTERFACE			
FEB, HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Manual initiation, F/C valve status		(1) A/B and GSE commands and logic	
GSE valve status		operations	
(2) Manual initiation, F/C valve status		(2) A/B valve commands and logical	
(3) Same initiation as (2) above		operations	
GSE valve status		(3) GSE valve commands and logic	
		operations	
(4) Analog and discretes		(4) Data (strip chart and CRT) and	
		compare monitoring	
(5) Same as (2)			
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO	USAGE
			W. R. ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO. 2.5	FUNCTIONS TITLE: Vent Remaining Pressurant		
FUNCTION: Control valves to safe the pressurization system			
REQUIREMENTS/DESCRIPTION			
(1) Control A/B and GSE valves for venting pressure			
(2) Monitor pressure periodically			
COMPUTER INTERFACE FEP, HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Manual initiation, A/B valve		(1) A/B and GSE valve commands genera-	
status; GSE valve status; A/B		tion and logic operations	
pressure status.		(2) Data (strip chart and CRT) and	
(2) Analog and discretes (pressure)		compare monitoring	
SOFTWARE <input checked="" type="checkbox"/> NON RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

# SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO. 2.10	FUNCTIONS TITLE: Isolate Mission Failed Hardware		
FUNCTION: Trouble shoot and identify bad LRUs			
REQUIREMENTS/DESCRIPTION (1) Select and test suspect systems/components to identify bad LRUs			
COMPUTER INTERFACE HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Flight performance data, manual		(1) A/B commands, simulations, logic	
initiation system parameters		operations, data identification of	
		failed LRU.	
SOFTWARE <input checked="" type="checkbox"/> NON RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO. 2.11	FUNCTIONS TITLE: Scheduled Tug Pre-Maintenance Tests			
FUNCTION: Functional and leak checks				
REQUIREMENTS/DESCRIPTION				
(1) Checkout vehicle				
(2) End to end calibration				
(3) Engine leak and functional tests				
(4) Leak check purge bag and APS system				
COMPUTER INTERFACE HIM				
INPUT DESCRIPTION		OUTPUT DESCRIPTION		
(1)-(4) Manual initiation, system		(1)-(4) Tug and GSE commands, logic		
parameters, valve status		operations, data, exception		
calibration curves		reports, trend analysis, timed		
		assess ents, leak rates		
SOFTWARE <input checked="" type="checkbox"/> NON RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:		
		FUNCTION BLOCK NO.	USACE	
			WTR	ETR

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## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO. 2.17		FUNCTIONS TITLE: Scheduled Adapter Maintenance and Modification	
FUNCTION: Accomplish scheduled maintenance, inspection and servicing			
REQUIREMENTS/DESCRIPTION			
(1) Control the functional check of the plumbing			
(2) Verify replaced or modified component system operation			
COMPUTER INTERFACE HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1)-(2) Manual initiation, system		(1)-(2) Tug commands, logic operations,	
parameters, valve status,		data, leak rates, exception	
calibration curves		reports	
SOFTWARE <input type="checkbox"/> NON RECURRING <input checked="" type="checkbox"/> RECURRING		SOFTWARE ALLOCATION	
		FUNCTION BLOCK NO	
		USAGE	
		WTR	ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 2.18		FUNCTIONS TITLE: Purge LH <sub>2</sub> Tank	
FUNCTION: Reduce H <sub>2</sub> concentration for safety			
REQUIREMENTS/DESCRIPTION			
(1) Control airborne LH <sub>2</sub> and He valves for a purge of the LH <sub>2</sub> tanks			
(2) Control GSE He valves for purging if required			
(3) Vent gas to a safe pressure and periodic pressure checks			
COMPUTER INTERFACE FEP			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Manual initiation, A/B valve		(1) A/B commands and logic operations	
status, volumetric gas analyzer		(2) GSE command and logic operations	
		integrated with airborne operations.	
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	
		USAGE	
		WTR	ETR



## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 4.6	FUNCTIONS TITLE: Leak Check Tug Pressurization System		
FUNCTION: Verify Integrity of Pressure System			
REQUIREMENTS/DESCRIPTION			
(1) Control and monitor GSE and A/B helium valves for leak check			
(2) Verify proper tank pressure regulation to LH <sub>2</sub> , LO <sub>2</sub> , APS, and fuel cell			
reactant tanks			
COMPUTER INTERFACE HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Manual initiation, valves status,		(1) A/B and GSE, commands, logic	
analog and discrete pressures		operations, parameter monitoring,	
		data	
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 4.8	FUNCTIONS TITLE: Leak Check LH <sub>2</sub> Tank			
FUNCTION: Verify LH <sub>2</sub> System Integrity				
REQUIREMENTS/DESCRIPTION				
(1) Control airborne valves for a pressurization and lockup cycle				
(2) Contingency control GSE helium valves pressurization source				
(3) Monitor pressures				
(4) Vent gas to a predetermined level				
COMPUTER INTERFACE HIM				
INPUT DESCRIPTION		OUTPUT DESCRIPTION		
(1) Manual initiation, A/B valve		(1) Commands and logic operations		
status				
(2) Same initiation as (1) above, GSE		(2) GSE commands and logic operations		
valve status		integrated with airborne		
(3) Analog and discrete pressures		(3) Data (strip chart and CRT) and		
		compare for decay		
(4) Same as (1)				
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:		
		FUNCTION BLOCK NO.	USAGE	
			WTR	ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 4.9		FUNCTIONS TITLE: Leak Check Fuel Cell Reactant Tanks	
FUNCTION: Verify reactant system integrity			
REQUIREMENTS/DESCRIPTION			
(1) Control airborne and GSE F/C valves for a pressurization and lockup cycle			
(2) Monitor pressures			
(3) Vent gas to a predetermined level			
COMPUTER INTERFACE			
HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Manual initiation, A/B valve status, GSE valve status, pressure switch or analog indication		(1) A/B and GSE valve commands, logic operations	
(2) Analog or discrete pressure		(2) Data (strip chart and CRT) and compare for decay	
(3) Same as (1)			
SOFTWARE <input checked="" type="checkbox"/> NON RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 4.7	FUNCTIONS TITLE: Leak Check LO <sub>2</sub> Tank		
FUNCTION: Verify LO <sub>2</sub> System Integrity			
REQUIREMENTS/DESCRIPTION			
(1) Control airborne valves for a pressurization and lockup cycle			
(2) Contingency control GSE valves during a pressurization and lockup cycle			
(3) Monitor pressures			
(4) Vent gas to 19 ± 1 psia and lock up pressure			
COMPUTER INTERFACE			
HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Manual initiation, A/B valve		(1) A/B commands and logic operations	
status			
(2) Same initiation as (1) above, GSE		(2) GSE commands and logic operations	
valve status		integrated with airborne	
(3) Analogs and discretes		(3) Data (strip chart and CRT)	
		and compare for decay	
(4) Same as (1)			
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO. 4.10	FUNCTIONS TITLE: Vent Remaining Pressurant		
FUNCTION: Safe Pressurization System			
REQUIREMENTS/DESCRIPTION			
(1) Control A/B and GSE valves for venting pressure to a predetermined level			
(2) Monitor pressure periodically			
COMPUTER INTERFACE			
HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Manual initiation; A/B valve		(1) A/B and GSE valve commands	
status; GSE valve status;		generation and logic operations	
pressure status		(2) Data (strip chart and CRT) and	
(2) Analog and discretes (pressure)		compare monitoring for decay	
SOFTWARE <input checked="" type="checkbox"/> NON RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 4.14	FUNCTIONS TITLE: Replaced Adapter Component and Modification Verification		
FUNCTION: Verify system performance after replaced component/modification activity			
REQUIREMENTS/DESCRIPTION (1) Verify replaced or modified component system operation			
COMPUTER INTERFACE HTM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Manual initiation, system		(1) Adapter commands, logic operations,	
parameters, valve status,		simulations, data, exception reports	
calibration curves			
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 4.17		FUNCTIONS TITLE: Electrical Pre-Power Checks	
FUNCTION: Verify Tug ready for power up and systems testing			
REQUIREMENTS/DESCRIPTION			
(1) Verify single point ground			
(2) Verify bus isolation			
(3) Verify signal isolation			
COMPUTER INTERFACE			
HTM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Test signal response		(1) Test signal; data (strip chart & CRT)	
(2)-(3) Test signal response		(2)-(3) Test signal; data (strip chart	
		and CRT) and exception reporting.	
		Logical scan sequence between	
		applied signal and other ports	
SOFTWARE		SOFTWARE ALLOCATION:	
<input type="checkbox"/> NON-RECURRING <input checked="" type="checkbox"/> RECURRING		FUNCTION BLOCK NO.	
		USAGE	
		WTR	ETR

# SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO 4.19	FUNCTIONS TITLE: Apply Power to Tug		
FUNCTION: Energize Tug subsystems and verify power quality			
REQUIREMENTS/DESCRIPTION			
(1) Selectively apply power to Tug buses			
(2) Selectively energize/de-energize each Tug subsystem and verify power quality.			
(3) Contingency power removal in the event of a fault			
COMPUTER INTERFACE HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1)-(2) Commands, power and ground monitor		(1)-(2) Logical application of power.	
		Noise and ripple comparison with standards. Data (strip chart and CRT)	
(3) Current/voltage		(3) Logical power removal. Identification of the circuit and fault	
SOFTWARE <input type="checkbox"/> NON-RECURRING <input checked="" type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR    ETR



## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 4.20	FUNCTIONS TITLE: Load PCM Data Format		
FUNCTION: Load Tug onboard computer with mission peculiar data format			
REQUIREMENTS/DESCRIPTION			
(1) Load mission peculiar data and format into the LPS.			
(2) Transfer data format to onboard computer			
(3) Verify onboard computer load			
COMPUTER INTERFACE HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) NASA or DOD mission parameters		(1) Verification of load into LPS	
(2) Manual initiation		(2) Data format transfer to onboard computer. Sum check, parity check	
(3) LPS and onboard load		(3) Reformat change to an alternate format and bit by bit compare.	
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

FUNCTION NO: 4.21		FUNCTIONS TITLE: Measurement System End-to-End Calibration	
FUNCTION: Calibrate measurement system			
REQUIREMENTS/DESCRIPTION (1) Stimulate end instruments and compare results with a standard for at least three voltage levels			
COMPUTER INTERFACE HTM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Calibration curve data manual initiation; automatic or semi-automatic procedure		(1) Data (strip chart, X-Y plotter and CRT). Logical progression of a series of variable stimulations.	
SOFTWARE <input type="checkbox"/> NON-RECURRING <input checked="" type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

# SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 4.22	FUNCTIONS TITLE: Replaced Component and Modification Verification		
FUNCTION: Verify system performance after replaced component/modification activity			
REQUIREMENTS/DESCRIPTION (1) Verify replaced or modified component system operation			
COMPUTER INTERFACE HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Manual initiation, system		(1) Tug and adapter commands, logic	
parameters, valve status,		operations, simulations, data,	
calibration curves		exception reports.	
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 4.23		FUNCTIONS TITLE: Post-Maintenance MLI Purge		
FUNCTION: Dry MLI and purge bay (if purge bag is opened during maintenance)				
REQUIREMENTS/DESCRIPTION (1) Control GSE and airborne N <sub>2</sub> hot purge valves and He slow purge valves.				
COMPUTER INTERFACE HIM				
INPUT DESCRIPTION		OUTPUT DESCRIPTION		
(1) Manual initiation, valve status,		(1) GSE and Tug valve commands.		
temperature and pressures		Logic operations, timed opera-		
(analog and discrete)		tions		
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:		
		FUNCTION BLOCK NO.	USAGE	
			WTR	ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 4.24	FUNCTIONS TITLE: Dry Tug Propellant Tanks		
FUNCTION: Dry new Tug propellant tanks to be compatible with cryogenics			
REQUIREMENTS/DESCRIPTION			
(1) Control airborne and GSE He, LO <sub>2</sub> and LH <sub>2</sub> valves to purge LO <sub>2</sub> and LH <sub>2</sub> tanks.			
(2) Pressurize tanks to a pre-determined pressure and periodic pressure checks.			
COMPUTER INTERFACE HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1)-(2) Manual initiation, A/B and		(1)-(2) A/B and GSE valve commands,	
GSE valve status, humidistat,		logic operations, exception	
pressure transducers (analog		reporting, data	
and discretes)			
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO	USAGE
			WTR ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 4.25	FUNCTIONS TITLE: Mate Tug with Kick Stage		
FUNCTION: Mechanical and electrical mate Tug with Kick Stage			
REQUIREMENTS/DESCRIPTION (1) LPS controls pin pullers			
COMPUTER INTERFACE HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Manual initiation, extend and		(1) Pin puller commands, logic	
retract position information		operations	
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 4.26	FUNCTIONS TITLE: Verify Interfaces and Prepare for SHE			
FUNCTION: Verify signal continuity across the Tug/kick stage interface and kick stage power activation.				
REQUIREMENTS/DESCRIPTION				
(1) Verify interface continuity pin by pin				
(2) Energize the Tug and apply power to the kick stage				
(3) Apply command signals and evaluate responses				
(4) Contingency power removal in the event of a fault				
COMPUTER INTERFACE HIM				
INPUT DESCRIPTION		OUTPUT DESCRIPTION		
(1) Test signal response		(1) Test signal. Data (strip chart and CRT), logical scan, exception reporting.		
(2)-(3) Commands, power and ground monitor, scan of non-applied interfaces.		(2)-(3) Logical application. Noise and ripple monitoring, data (strip chart and CRT)		
(4) Current/voltage		(4) Logical power removed. Identification of the circuit and the fault		
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:		
		FUNCTION BLOCK NO.	USAGE	
			WTR	ETR

# SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 4.27		FUNCTIONS TITLE: Load and Verify Computer Software	
FUNCTION: Load Tug Computer with Test Software			
REQUIREMENTS/DESCRIPTION			
(1) Load the Tug computer from the LPS			
(2) Verify that the Tug computer is correctly loaded			
COMPUTER INTERFACE HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Test program		(1) Verification that the Tug	
		computer is loading sum check,	
		parity check	
(2) LPS and Tug computer loads		(3) Bit by bit comparison	
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR



FUNCTION NO: 4.28		FUNCTIONS TITLE: Systems Health Evaluation	
FUNCTION: Verify Tug Subsystem Flight Gos and No-gos.			
REQUIREMENTS/DESCRIPTION (1) Verify normal flight mode of the Tug or Tug/kick stage			
(2) Verify flight mode redundancies			
(3) Verify time critical functions			
COMPUTER INTERFACE HM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1)-(3) Manual initiation, A/B system parameters, previous performance data		(1)-(3) A/B commands, logic operations, data management, trend data comparison	
SOFTWARE <input type="checkbox"/> NON-RECURRING <input checked="" type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	
		USAGE	
		WTR	ETR

# SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 4.39		FUNCTIONS TITLE: Kick Stage Power and Distribution System Checkout	
FUNCTION: Verify proper power and power distribution			
REQUIREMENTS/DESCRIPTION			
(1) Selectively apply power to kick stage buses			
(2) Selectively energize/de-energize each kick stage subsystem and verify power quality and distribution			
(3) Contingency remove power in the event of a fault.			
COMPUTER INTERFACE HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1)-(2) Manual initiation of commands, power and ground monitor		(1)-(2) Logical application of power. Noise and ripple comparison. Data (strip chart and CRT)	
(3) Current/voltage		(3) Logical power removal; flag circuit and fault.	
SOFTWARE <input type="checkbox"/> NON-RECURRING <input checked="" type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR    ETR

# SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 4.40		FUNCTIONS TITLE: Measurement System End to End Calibration	
FUNCTION: Calibrate measurement system (kick stage)			
REQUIREMENTS/DESCRIPTION (1) Stimulate end instruments and compare results with a standard for at least three voltage levels.			
COMPUTER INTERFACE HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Calibration curve data. Manual initiation. Automatic or semi-automatic procedure		(1) Data (strip chart, x-y plotter and CRT). Logical progression of a series of variable stimulations.	
SOFTWARE <input type="checkbox"/> NON-RECURRING <input checked="" type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 4.41	FUNCTIONS TITLE: APS Pressure/Leak Checks		
FUNCTION: Verify pressure and functional integrity of kick stage APS			
REQUIREMENTS/DESCRIPTION			
(1) Control airborne and GSE valves for a pressurization and lockup cycle.			
(2) Monitor pressures			
(3) Control venting			
COMPUTER INTERFACE HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Manual initiation, A/B and GSE valve status. Pressure transducers (analog)		(1) A/B and GSE commands, logic operations	
(2) Analog and discretes (pressure)		(2) Data (strip chart and CRT), pressure monitoring and comparison against a standard.	
(3) Same as (1)			
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 4.42	FUNCTIONS TITLE: APS Functional Checks		
FUNCTION: Verify proper APS valve response			
REQUIREMENTS/DESCRIPTION			
(1) Perform APS functional test to verify proper APS valve responses,			
i.e., logical sequences and timed reaction			
COMPUTER INTERFACE			
HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Manual initiation, simulation		(1) APS valve commands, data (strip	
of anomalies		chart and CRT)	
SOFTWARE		SOFTWARE ALLOCATION:	
<input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		FUNCTION BLOCK NO.	
		USAGE	
		WTR	ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 4.43	FUNCTIONS TITLE: Control System Checkout			
FUNCTION: Verify control system's ability to determine spatial position and provide proper response.				
REQUIREMENTS/DESCRIPTION				
(1) Control GSE and A/B power.				
(2) Verify autopilot performance and system response, timing and phasing.				
(3) Verify operation of flight computer, IMU, star tracker, sun sensor, etc.				
COMPUTER INTERFACE HIM				
INPUT DESCRIPTION		OUTPUT DESCRIPTION		
(1) Manual initiation, voltage sensing, current.		(1) Logical sequence power control, contingency power removal.		
(2) Manual initiation system parameters.		(2) Sequence of stimulations and simulations. Data (X-Y plotter, strip chart, CRT) logical sequencing and evaluation of sub-results.		
(3) System parameters test programs.		(3) Go-no go sequences, special stimuli, simulations logical evaluation of results.		
SOFTWARE <input type="checkbox"/> NON RECURRING <input checked="" type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:		
		FUNCTION BLOCK NO.	USAGE	
			WTR	ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 4.44	FUNCTIONS TITLE: RF System Checkout - Kick Stage		
FUNCTION:			
Verify functional operation of communications and data management systems.			
REQUIREMENTS/DESCRIPTION			
(1) Control power application.			
(2) Perform RF system functional checkout.			
(3) Verify data management system capability to store, condition, time tag, and multiplex information.			
(4) Verify central logic/computer and C&W.			
COMPUTER INTERFACE			
HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Manual initiation, current and voltage sensing.		(1) Logical power application and contingency removal.	
(2) Manual initiation.		(2) Commands and simulations. Data (CRT) logic evaluations of frequencies, power, spectral contents, VSWR, sensitivity.	
(3) Initiation		(3) Commands logical simulations. Storage of received and non-received data. Logic evaluation of data modes.	
(4) System parameters, test programs		(4) Go-no go sequences and stimuli. Logic evaluations of sub-tests.	
SOFTWARE <input type="checkbox"/> NON-RECURRING <input checked="" type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 4.46	FUNCTIONS TITLE: CST Preps - Kick Stage			
FUNCTION:				
Configure kick stage systems for combined systems test.				
REQUIREMENTS/DESCRIPTION				
(1) Control GSE and airborne power application.				
(2) Load flight programs.				
(3) Assess ready for test.				
COMPUTER INTERFACE				
HIM				
INPUT DESCRIPTION		OUTPUT DESCRIPTION		
(1) Manual initiation, current and voltage sensing.		(1) Logical power application and contingency removal.		
(2) Tape or disc flight programs.		(2) Load and verify loaded flight computer program.		
(3) System simulation results.		(3) Simulations, logical sample test sequences, ordnance test device continuity sequences data (strip chart, CRT, X-Y plot time) health monitor check - logic comparisons of readiness.		
SOFTWARE <input type="checkbox"/> NON-RECURRING <input checked="" type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:		
		FUNCTION BLOCK NO.	USAGE	
			WTR	ETR



## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 4.47		FUNCTIONS TITLE: Combined System Test	
FUNCTION: Kick stage functional test of a simulated mission.			
REQUIREMENTS/DESCRIPTION (1) Operate kick stage systems in a compressed time functional test from countdown thru S/C separation.			
COMPUTER INTERFACE HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Manual initiation system parameters		(1) Logical application of commands,	
and responses.		stimuli and simulations. Compari-	
		son of responses with standards.	
		Data (CRT, X-Y plotter, strip	
		chart) exception reporting,	
		sequence status.	
SOFTWARE <input type="checkbox"/> NON-RECURRING <input checked="" type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR    ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 5.1	FUNCTIONS TITLE: Tug and Spacecraft Mate		
FUNCTION: Mechanically mate S/C to tug or kick stage.			
REQUIREMENTS/DESCRIPTION LPS controls pin pullers.			
COMPUTER INTERFACE HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Manual initiation, extend and		(1) Pin puller commands, logic	
retract position information.		operations.	
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

# SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 5.2	FUNCTIONS TITLE: Load and Verify Tug Computer Software			
FUNCTION: Load tug computer flight software.				
REQUIREMENTS/DESCRIPTION				
(1) Load the tug computer from the LPS.				
(2) Verify that the tug computer is loaded properly.				
(3) Change mission parameters and repeat (1) and (2).				
COMPUTER INTERFACE				
INPUT DESCRIPTION		OUTPUT DESCRIPTION		
(1) Flight program (tape, disc, or wide band data stream).		(1) Verification that the tug computer is loading. Sure check, parity check.		
(2) LPS and tug computer loads.		(2) Bit by bit comparison.		
(3) New mission parameters (tape, disc, etc.) (1) and (2) repeat.		(3) Repeat (1) and (2).		
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:		
		FUNCTION BLOCK NO.	USAGE	
			WTR	ETR

# SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO:		FUNCTIONS TITLE:	
5.3		Connect S/C Simulator	
FUNCTION: Verify docking/retrieval capability.			
REQUIREMENTS/DESCRIPTION			
(1) Monitor latching mechanism.			
COMPUTER INTERFACE			
HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Mechanism position information.		(1) Data (time tag, CRT) logical  check sequence.	
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR    ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 5.4	FUNCTIONS TITLE: Functional Interface Test (FIT)		
FUNCTION: Functionally verify all Tug/kick stage/S/C interfaces.			
REQUIREMENTS/DESCRIPTION			
(1) Verify single point ground and bus isolation.			
(2) Provide flight stimuli and verify mission operation.			
COMPUTER INTERFACE			
HIM; FEP			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Test signal response.		(1) Test signal. Data (strip chart and	
		CRT) exception reporting. Logical	
		scan between applied bus and other	
		buses.	
(2) System parameters and responses.		(2) Command MSS/PSS to start mission,	
		provide flight go and no-go stimuli	
		(logical operations). Monitor	
		MSS/PSS evaluations. Evaluate all	
		test data.	
SOFTWARE		SOFTWARE ALLOCATION:	
<input type="checkbox"/> NON-RECURRING <input checked="" type="checkbox"/> RECURRING		FUNCTION BLOCK NO.	
		USAGE	
		WTR	ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 5.5		FUNCTIONS TITLE: S/C to STDN/TDRSS/SCF Comm Verification	
FUNCTION: Verify the payload uplink and downlink to each segment's controlling ground station.			
REQUIREMENTS/DESCRIPTION (1) Tug rf ground station(s) execute command and verify open loop response. (2) Kick stage rf ground station command and response check. (3) S/C rf ground station command and response check.			
COMPUTER INTERFACE HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1)-(3) Manual initiation, subtest completion information.		(1)-(3) Commands to the rf checkout test set, simulations (if required) to the tug, data (CRT), logic evaluations of frequencies, power, sensitivity.	
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 5.6	FUNCTIONS TITLE: Payload to Orbiter Comm Verification		
FUNCTION: Verify rf compatibility between the orbiter and tug communications systems.			
REQUIREMENTS/DESCRIPTION			
(1) Verify all tug to and from orbiter rf commands and responses.			
COMPUTER INTERFACE			
FEP; HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Subtest completion information.		(1) Orbiter commands to be sent to the	
		tug, simulations (if required) to	
		the tug, data (CRT), logic evalua-	
		tions of open loop parameters of	
		both the tug and orbiter.	
SOFTWARE		SOFTWARE ALLOCATION:	
<input type="checkbox"/> NON-RECURRING <input checked="" type="checkbox"/> RECURRING			
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 5.1C		FUNCTIONS TITLE: Partial Tug Pressurant Load	
FUNCTION: Pressurize tug pressurization system to 1/3 flight pressure.			
REQUIREMENTS/DESCRIPTION			
(1) Control GSE and tug valves to pressurize tug to 1100 psi.			
(2) Monitor pressures periodically.			
COMPUTER INTERFACE			
HIM; FEP			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Manual initiation; A/B and GSE valve status; A/B pressure status.		(1) A/B and GSE valve command generation and logic operations.	
(2) Analog and discretes (pressure).		(2) Data (strip chart and CRT) and compare monitoring.	
SOFTWARE		SOFTWARE ALLOCATION:	
<input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		FUNCTION BLOCK NO.	
		USAGE	
		WTR	ETR



FUNCTION NO: 5.21		FUNCTIONS TITLE: Tug and Spacecraft Mate	
FUNCTION:			
Mechanically mate the S/C to the tug or kick stage.			
REQUIREMENTS/DESCRIPTION			
(1) LPS controls pin pullers.			
COMPUTER INTERFACE			
HIM			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Manual initiation, extend and retract position information.		(1) Pin puller commands, logic operations.	
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 6.7	FUNCTIONS TITLE: Payload-Orbiter Interface Verification			
FUNCTION:				
Verify payload-orbiter interface integrity.				
REQUIREMENTS/DESCRIPTION				
(1) Verify interface continuity pin by pin and all interface connectors mated.				
(2) LPS energizes the tug primary power bus.				
(3) LPS addresses and evaluates replies from each P/L computer.				
(4) Control propellant tank insulation purge.				
COMPUTER INTERFACE				
HIM and FEP				
INPUT DESCRIPTION		OUTPUT DESCRIPTION		
(1) Test signal response.		(1) Test signal, data (strip chart and		
		CRT), logical scan, exception		
		reporting.		
(2) Commands, current and voltage		(2) Logical application and contingency		
monitor.		removal of power. Data (strip		
		chart and CRT).		
(3) Manual initiation; P/L computer		(3) Test routine initiation in logical		
replies.		sequence for each P/L computer.		
		Data (status, CRT).		
(4) Tug and GSE valve status, pressure		(4) Logical Tug and GSE valves command		
(analog and discretes).		generation.		
SOFTWARE <input type="checkbox"/> NON-RECURRING <input checked="" type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:		
		FUNCTION BLOCK NO.	USAGE	
			WTR	ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 6.8	FUNCTIONS TITLE: Payload Measurement Profile		
FUNCTION:			
Establish pre-launch data baseline profile.			
REQUIREMENTS/DESCRIPTION			
(1) Selectively apply power to the complete payload.			
(2) Record ambient end instrument data.			
COMPUTER INTERFACE			
FEP			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Manual initiation of command		(1) Logical application of power.	
Sequence, voltage and current		Data (strip chart and CRT).	
monitor.			
(2) P/L interleaved data		(2) Data recording and real time evalua-	
		tion of data.	
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

FUNCTION NO: 6.9		FUNCTIONS TITLE: Orbiter-P/L Functional Interface Systems Test	
FUNCTION:			
Verify that the P/L and Orbiter are ready to support the mission.			
REQUIREMENTS/DESCRIPTION			
(1) Perform an abbreviated mission (launch through landing) test. LPS simulates flight parameters, stimulates sensors, evaluates results, checks the PMS evaluation, and re-evaluates the data management system.			
COMPUTER INTERFACE HIM, FEP, Decomm			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) On-board initiation, Orbiter P/L data.		(1) Sequential simulations and stimulations, logic operations (compare data), data recording and status (tape, CRT, strip chart).	
SOFTWARE <input type="checkbox"/> NON-RECURRING <input checked="" type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 7.1	FUNCTIONS TITLE: Tug Pressurant and Fuel Cell Loading		
FUNCTION:			
Complete tug pressurant loading and load fuel cell reactants.			
REQUIREMENTS/DESCRIPTION			
(1) Control airborne F/C and GSE helium valves during F/C pressurization.			
(2) Control airborne F/C and GSE LO <sub>2</sub> and LH <sub>2</sub> valves during F/C loading and topping.			
(3) Initiate and monitor main tanks pressure integrity check with orbiter piping connected.			
COMPUTER INTERFACE			
FEP and HIM (GSE)			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1)-(2) Master sequence initiation, A/B and GSE valve status, pressure switch or transducer.		(1)-(2) F/C A/B and GSE He and propellants valve commands, logic operations on valve sequence and contingency safing. Data (strip chart or CRT).	
(3) Master sequence initiation A/B and GSE valve status and pressure switch or transducer.		(3) A/B and GSE He valves commands, logic operations. Data (strip chart).	
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

## SOFTWARE REQUIREMENT SPECIFICATION DATA SHEET

FUNCTION NO: 7.2	FUNCTIONS TITLE: Countdown		
FUNCTION:			
Load shuttle propellants.			
REQUIREMENTS/DESCRIPTION			
(1) Control LO <sub>2</sub> and LH <sub>2</sub> airborne and GSE tug valves during loading for launch.			
(2) Final payload Go-No-go tests.			
COMPUTER INTERFACE			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Master sequence initiation, A/B		(1) A/B and GSE LH <sub>2</sub> and LO <sub>2</sub> valve	
and GSE valve status, pressure		commands, logic operations.	
switches or transducer, liquid			
sensors.			
(2) Tug parameters.		(2) Sequencing, data, comparisons.	
SOFTWARE <input type="checkbox"/> NON-RECURRING <input checked="" type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR ETR

FUNCTION NO: 7.3		FUNCTIONS TITLE: Terminal Countdown and Launch	
FUNCTION:			
Launch shuttle.			
REQUIREMENTS/DESCRIPTION			
(1) Monitor tug countdown operations and critical parameters during the critical count.			
(2) Safe the facility.			
(3) Post launch GSE damage assessment.			
COMPUTER INTERFACE			
FEP; HIM (GSE)			
INPUT DESCRIPTION		OUTPUT DESCRIPTION	
(1) Master sequence initiation, tank pressures, valve status.		(1) Comparisons of normal airborne functions, status, data (record).	
(2)-(3) Valve status, pressures, fire sensors (analog and discretes).		(2)-(3) GSE valve commands, status, data.	
SOFTWARE <input checked="" type="checkbox"/> NON-RECURRING <input type="checkbox"/> RECURRING		SOFTWARE ALLOCATION:	
		FUNCTION BLOCK NO.	USAGE
			WTR    ETR

## MAINTENANCE REQUIREMENTS

1.0 General - Maintenance requirement analysis was performed to determine maintenance actions, tasks and frequencies, required to maintain the baseline Tug operational reliabilities of 0.97 for mission accomplishment. Also identified are the maintenance methods employed. The support equipment and facilities required, along with estimates of the time and personnel required to perform each maintenance action are identified on the Tug function description data sheet. In addition, component removal frequencies, mean time between failures, and mean time to replace predictions are provided for use in unscheduled maintenance, as well as off vehicle repair and spares requirements determinations. These data are documented on the Maintenance Requirements Data Sheets.

For identification and control purposes, all tasks have been numbered in accord with the Functional Flow Diagram.

2.0 Maintenance Techniques - Time, on-condition, and conditioning monitoring philosophies were considered for application to Tug maintenance. These philosophies are defined as follows:

2.1 Time - A component or item controlled on a time technique has a limit set in terms of hours, cycles, flights, calendar time, or other measures of time or events, at which limit the component or item must be removed and processed in the shop for return to zero-time.

2.2 On Condition - A maintenance technique under which a determination of the condition of a component or item is made, at specified intervals, via measurement, test or other means, without removal, disassembly inspection or overhaul. Principally considered ground checkout activities.

2.3 Condition Monitoring - A maintenance concept having neither hard-time limits nor on-condition as a primary maintenance process. Condition



monitoring is accomplished by having appropriate means of condition assessment available for detecting and resolving problem areas. These means range from notices of system operation problems and special analysis of unit performance on a whole fleet basis, to real time monitoring of individual unit performance during operation.

There is implicit in these latter two concepts, the requirement that the condition assessment functions must disclose enough information about the item's health and failure resistance to ensure a reasonable confidence in its reliability for the next flight or time interval before the determination will be made again.

Examination of the Tug, its subsystems and components reveal that the foregoing maintenance techniques are applicable to the Tug. The Tug is comprised of few items having life/cycle limits within the planned operational life utilization (20 missions) of an individual vehicle. Therefore, the application of the time maintenance technique to the Tug will be minimal.

The baseline Tug, by necessity, will be well instrumented for flight control and safety purposes; and therefore, promotes the application of the condition monitoring concept in that functional condition assessment of a majority of components can be made via data generated during flight operations. Where instrumentation or information is lacking, functional checks or other on-condition, condition assessment actions will be performed.

3.0 Levels of Maintenance - Consistent with the Orbiter Maintenance Plan, the preliminary Tug plan shall provide for maintenance to be accomplished at three levels, in terms of where the activity is performed.

They are:

3.1 Level I - All maintenance activities performed directly on installed hardware. It includes on-vehicle fault detection, isolation, correction, and prevention through application of functions such as inspection, checkout, calibration, adjustment, repair, removal and replacement, servicing, etc.

3.2 Level II - Maintenance activities performed in direct support of Level I, consisting of repair and/or disposition of hardware removed during Level I maintenance. Level II maintenance will be performed at maintenance shops located at the launch site. The maintenance accomplished could range from preparation for shipment to Level III, through complete overhaul. The extent of Level II activity will be determined primarily by the economics involved in providing or not providing for the capabilities needed to accomplish the maintenance required and not necessarily by the nature or complexity of the required maintenance activity.

3.3 Level III - Those maintenance activities, performed in direct support of Levels I and II, which will be performed at off site locations such as contractor or vendor facilities or government facilities where the required skills, equipment, and/or facilities are available.

4.0 Types of Maintenance - The program consists of two types of activities, namely, scheduled and unscheduled maintenance. Scheduled maintenance is comprised of tasks or actions to be accomplished at specified intervals. The objective of these functions is to retain the inherent design level of reliability through analysis of flight data, inspection, checkout, calibration, adjustment, servicing, repair, removal, and replacement, etc., at specified times or intervals. Unscheduled maintenance is essentially corrective action resulting from scheduled tasks and condition monitoring and is comprised of essentially the same activities as scheduled mainten-

ance except they are performed for the express purpose of restoring degraded equipment to its original level of reliability.

4.1 The primary method of accomplishing unscheduled, "corrective", maintenance will be through removal and replacement of the faulty line replaceable units (LRU).

4.2 Unscheduled maintenance will be performed in parallel with scheduled maintenance to the maximum degree practicable, and

4.3 Maintenance will be done concurrently on all subsystems (avionics, propulsion, structures, etc.) to the maximum extent practicable.

4.4 The criticality of each Tug component was based on the following criteria.

a. Function criticality:

1. Any single failure that can compromise safety of orbiter crew.
2. Any single failure that can cause loss of Tug or payload.
3. Any single failure that can cause loss of Tug mission.
4. All others.

b. Criticality considers:

Premature operation

Failure to operate on command

Improper operation.

5.0 Maintenance Requirements Data Sheets - The following data sheets identify the maintenance requirements associated with the various baseline Tug components, subsystems/system and structures from the time the Tug arrives at the Tug processing facility (TPF) until the Tug is ready for installation in the Orbiter payload bay or placement in storage. Table 5-1 identifies those items for which maintenance requirements data sheets exist.

TABLE 5-1 MAINTENANCE REQUIREMENTS EVALUATION

ITEM	CRITICALITY	SYSTEM/COMPONENT IDENTIFICATION	MAINT. LEVEL			MAINT. TYPE		LRU		SPARE REQD.		LEGEND: REMARKS
			LEVEL I	LEVEL II	LEVEL III	SCHED.	UNSCHED.	YES	NO	YES	NO	
1	-	Structures System	-	-	-	-	-	-	-	-	-	Not evaluated at this level
2	2	Forward Skirt	X	X		X	X		X	X		
3	3	Docking Mechanism	X	X		X	X	X		X		
4	2	Main Skirt	X	X		X	X		X	X		
5	2	LH <sub>2</sub> Tank	X			X	X		X		X	
6	2	LO <sub>2</sub> Tank	X			X			X		X	
7	4	LH <sub>2</sub> Tank Support	X			X	X	X		X		
8	4	LO <sub>2</sub> Tank Support	X			X	X	X		X		
9	4	Thrust Structure	X			X	X	X		X		
10	2	Aft Adapter	X	X		X	X		X	X		
11	4	Latching Mechanism	X	X		X	X	X		X		
12	-	Propulsion System	-	-	-	-	-	-	-	-	-	Not evaluated at this level.
13	2	Main Engines	X	X		X	X	X		X		
14	-	Feed, fill, drain & vent S/S	-	-	-	-	-	-	-	-	-	Not evaluated at this level.
15	4	(F&D) Solenoid Cont. Valve	X	X		X	X	X		X		
16	4	(F&D) LH <sub>2</sub> Fill & Drain Valve	X	X		X	X	X		X		
17	4	(F&D) LH <sub>2</sub> Horiz. Dump Valve	X	X		X	X	X		X		
18	4	(F&D) LH <sub>2</sub> Fill, Drain & Prevalve	X	X		X	X	X		X		
19	4	(F&D) LH <sub>2</sub> Coupler	X			X	X	X		X		

TABLE 5-1 MAINTENANCE REQUIREMENTS EVALUATION

ITEM	CRITICALITY	SYSTEM/COMPONENT IDENTIFICATION	MAINT. LEVEL			MAINT. TYPE		LRU		SPARE REQD.		LEGEND: REMARKS
			LEVEL I	LEVEL II	LEVEL III	SCHED.	UNSCHED.	YES	NO	YES	NO	
20	4	(F&D) LH <sub>2</sub> Flex Line	X			X	X	X		X		
21	4	(F&D) LH <sub>2</sub> Quick Disconnect	X			X	X	X		X		
22	4	(Vent) LH <sub>2</sub> Vert. Vent Valve	X	X		X	X	X		X		
23	4	(Vent) LH <sub>2</sub> Horiz. Vent Valve	X	X		X	X	X		X		
24	4	(Vent) LH <sub>2</sub> Thermodyn. Vent	X			X	X	X		X		
25	4	(F&D) LO <sub>2</sub> Fill, Drain & Dump Valve	X	X		X	X	X		X		
26	4	(F&D) LO <sub>2</sub> Prevalve	X	X		X	X	X		X		
27	4	(F&D) LO <sub>2</sub> Coupler	X			X	X	X		X		
28	4	(F&D) LO <sub>2</sub> Flex Line	X			X	X	X		X		
29	4	(F&D) LO <sub>2</sub> Quick Disconnect	X			X	X	X		X		
30	4	(Vent) Solenoid Cont. Valve	X	X		X	X	X		X		
31	4	(Vent) LO <sub>2</sub> Vent Valve	X	X		X	X	X		X		
32	4	(Vent) LO <sub>2</sub> Thermodyn. Vent	X			X	X	X		X		
33	4	(F&D) LH <sub>2</sub> Plumbing	X			X	X		X		X	
34	4	(Vent) LH <sub>2</sub> Plumbing	X			X	X		X		X	
35	4	(F&D) LO <sub>2</sub> Plumbing	X			X	X		X		X	
36	4	(Vent) LO <sub>2</sub> Plumbing	X			X	X		X		X	
37	4	(F&D) Pneumatic Plumb.	X			X	X		X		X	
38	-	Pressurization S/S	-	-	-	-	-	-	-	-	-	
39	3	Helium Sphere	X			X	X	X		X		

TABLE 5-1 MAINTENANCE REQUIREMENTS EVALUATION

ITEM	CRITICALITY	SYSTEM/COMPONENT IDENTIFICATION	MAINT. LEVEL			MAINT. TYPE		LRU		SPARE REQD.		LEGEND: REMARKS
			LEVEL I	LEVEL II	LEVEL III	SCHED.	UNSCHED.	YES	NO	YES	NO	
40	4	Solenoid Control Valve	X	X		X	X	X		X		Not evaluated at this level.
41	4	Helium Regulator	X			X	X	X		X		
42	4	Filter Assembly	X			X	X	X		X		
43	4	Helium Vent Valve	X	X		X	X	X		X		
44	4	Helium Quick Disconnect	X			X	X	X		X		
45	4	Helium Coupler	X			X	X	X		X		
46	4	Helium Plumbing	X			X	X		X		X	
47	-	Hydraulic S/S	-	-	-	-	-	-	-	-	-	
48	4	Actuator Assembly	X	X		X	X	X		X		
49	4	Main Pump	X	X		X	X	X		X		
50	4	Auxiliary Pump	X	X		X	X	X		X		
51	4	Check Valve	X	X		X	X	X		X		
52	4	Solenoid Seq. Valve	X	X		X	X	X		X		
53	4	Hi Press. Relief Valve	X	X		X	X	X		X		
54	4	Lo Press. Relief Valve	X	X		X	X	X		X		
55	4	Bleed Valve	X	X		X	X	X		X		
56	4	Filter	X			X	X	X		X		
57	4	Hydr. Plumbing	X			X	X		X		X	
58	-	Prop. Load. & Measure. S/S	-	-	-	-	-	-	-	-	-	
59	3	LO <sub>2</sub> Capacitive Mass Probe	X		X	X	X	X		X		
60	3	LH <sub>2</sub> Capacitive Mass Probe	X		X	X	X	X		X		
61	4	LO <sub>2</sub> Control Assembly	X	X		X	X	X		X		

TABLE 5-1 MAINTENANCE REQUIREMENTS EVALUATION

ITEM	CRITICALITY	SYSTEM/COMPONENT IDENTIFICATION	MAINT. LEVEL			MAINT. TYPE		LRU		SPARE RECD.		LEGEND:
			LEVEL I	LEVEL II	LEVEL III	SCHED.	UNSCHED.	YES	NO	YES	NO	REMARKS
62	4	LH <sub>2</sub> Control Assembly	X	X		X	X	X		X		Not evaluated at this level.
63	4	Power Supply	X	X		X	X	X		X		
64	4	Point Level Sensors	X			X	X	X		X		
65		Deleted										
66	-	APS Subsystem	-	-	-	-	-	-	-	-	-	
67	4	APS Motor Assembly	X	X		X	X	X		X		
68		Deleted										
69	4	Solenoid Fuel Prevalve	X	X		X	X	X		X		
70	3	Filter	X			X	X	X		X		
71		Deleted										
72	4	N <sub>2</sub> H <sub>4</sub> Fill Q.D.	X			X	X	X		X		
73	4	N <sub>2</sub> H <sub>4</sub> Vent Q.D.	X			X	X	X		X		
74	4	N <sub>2</sub> H <sub>4</sub> Prop. Tank	X	X		X	X	X		X		
75	4	Helium Vent Valve	X	X		X	X	X		X		
76	4	Helium Vent Q.D.	X			X	X	X		X		
77		Deleted										
78	4	Helium Regulators	X	X		X	X	X		X		
79	4	Helium Sphere	X	X		X	X	X		X		
80	4	Helium Quick Disconnect	X			X	X	X		X		
81	-	Thermal Control System	-	-	-	-	-	-	-	-	-	Not evaluated at this level.
82	-	Active Thermal Cont. S/S	-	-	-	-	-	-	-	-	-	Not evaluated at this level.
83	4	Electrical Heater	X			X	X	X		X		
84	3	Freon Accumulator	X	X		X	X	X		X		

TABLE 5-1 MAINTENANCE REQUIREMENTS EVALUATION

ITEM	CRITICALITY	SYSTEM/COMPONENT IDENTIFICATION	MAINT. LEVEL			MAINT. TYPE		LRU		SPARE REQD.		LEGEND:	
			LEVEL I	LEVEL II	LEVEL III	SCHED.	UNSCHED.	YES	NO	YES	NO	REMARKS	
85	4	Freon Fill Valve	X			X	X	X		X			
86	4	Freon Pump	X		X	X	X	X		X			
87	4	Dryer Assembly	X			X	X	X		X			
88	4	Filter	X			X	X	X		X			
89	4	Filter Bypass Valve	X	X		X	X	X		X			
90	4	Heat Exchanger	X			X	X	X		X			
91	3	Radiator	X			X	X	X		X			
92	3	Selector Valve	X	X		X	X	X		X			
93	4	Flow Cont. Valve	X	X		X	X	X		X			
94	3	Temp. Sensor	X			X	X	X		X			
95	4	He. Cont. Valve	X	X		X	X	X		X			
96		He Regulator Valve	X	X		X	X	X		X			
97		He Vent Valve	X	X		X	X	X					
98		Heat Pipe	X			X	X	X		X			
99	4	Thermal Splice	X			X	X	X		X			
100	-	LH <sub>2</sub> Tank Insulation S/S	-	-	-	-	-	-	-	-	-		Not evaluated at this level.
101	4	Multilayer Insulation	X			X			X		X		Non-repairable
102	4	Purge Bag	X			X	X		X		X		Repair limited to patch only.
103	-	LO <sub>2</sub> Tank Insulation S/S	-	-	-	-	-	-	-	-	-		Not evaluated at this level.
104	4	Multilayer Insulation	X			X			X		X		Non-repairable
105	4	Purge Bag	X			X	X		X		X		Repair limited to patch only.
106	-	Insulation Purge S/S	-	-	-	-	-	-	-	-	-		Not evaluated at this level.



TABLE 5-1 MAINTENANCE REQUIREMENTS EVALUATION

ITEM	CRITICALITY	SYSTEM/COMPONENT IDENTIFICATION	MAINT. LEVEL			MAINT. TYPE		LRU		SPARE REQD.		LEGEND: REMARKS
			LEVEL I	LEVEL II	LEVEL III	SCHED.	UNSCHED.	YES	NO	YES	NO	
107	4	LH <sub>2</sub> Purge Press. Reg.	X			X	X	X		X		
108	4	LO <sub>2</sub> Purge Press. Reg.	X			X	X	X		X		
109	4	LH <sub>2</sub> Purge Cont. Valve	X	X		X	X	X		X		
110	4	LO <sub>2</sub> Purge Cont. Valve	X	X		X	X	X		X		
111	4	LH <sub>2</sub> Purge Vent Valve	X	X		X	X	X		X		
112	4	LO <sub>2</sub> Purge Vent Valve	X	X		X	X	X		X		
113	-	Passive Thermal Cont. S/S	-	-	-	-	-	-	-	-	-	Not evaluated at this level.
114	4	Radiation Shield	X			X	X	X		X		Evaluated with structures.
115	4	Thermal Coating	X			X	X		X		X	
116	-	Avionics System	-	-	-	-	-	-	-	-	-	Not evaluated at this level.
117	-	NG&C Subsystem	-	-	-	-	-	-	-	-	-	Not evaluated at this level.
118	4	Inertial Mea. Unit	X		X	X	X	X		X		
119	4	Rate Gyro	X		X	X	X	X		X		
120	4	Accelerometer	X		X	X	X	X		X		
121	4	Star Tracker	X		X	X	X	X		X		
122	4	Sun Sensor	X		X	X	X	X		X		
123	4	Elect. Control Unit	X		X	X	X	X		X		
124	-	Rendezvous & Docking S/S	-	-	-	-	-	-	-	-	-	Not evaluated at this level.
125	3	Laser Radar	X		X	X	X	X		X		Not evaluated at this level.
126	3	Laser Radar Elect.	X		X	X	X	X		X		
127	-	Data Management S/S	-	-	-	-	-	-	-	-	-	
128	3	Digital Computer	X		X	X	X	X		X		

TABLE 5-1 MAINTENANCE REQUIREMENTS EVALUATION

ITEM	CRITICALITY	SYSTEM/COMPONENT IDENTIFICATION	MAINT. LEVEL			MAINT. TYPE		LRU		SPARE REQD.		LEGEND:
			LEVEL I	LEVEL II	LEVEL III	SCHED.	UNSCHED.	YES	NO	YES	NO	REMARKS
129	4	Auxiliary Memory	X		X	X	X	X		X		Not evaluated at this level.
130	4	Comp. I/F Unit	X		X	X	X	X		X		
131	4	Data I/F Unit	X		X	X	X	X		X		
132	4	Orbiter I/F Unit	X		X	X	X	X		X		
133	4	Tape Recorder	X		X	X	X	X		X		
134	4	Buffer/Formatter	X		X	X	X	X		X		
135	-	Communications S/S	-	-	-	-	-	-	-	-	-	
136	3	AESPA	X		X	X	X	X		X		
137	3	Command Decoder	X	X		X	X	X		X		
138		Deleted										
139	4	TV Camera	X	X		X	X	X		X		
140	4	TV Electronics	X	X		X	X	X		X		
141	-	Measurements S/S	-	-	-	-	-	-	-	-	-	
142	4	Signal Conditioners	X	X		X	X	X		X		
143	4	Temp. Sensor	X			X	X	X		X		
144	4	Press. Sensor	X			X	X	X		X		
145	4	Position Sensor	X			X	X	X		X		
146	4	Tachometer	X			X	X	X		X		
147	4	Accelerometer	X			X	X	X		X		
148	4	Flow Sensor	X			X	X	X		X		
149	4	Voltage Sensor	X	X		X	X	X		X		
150	4	Liquid Level Sensors	X			X	X	X		X		
151	4	Strain Gages	X			X	X	X		X		

TABLE 5-1 MAINTENANCE REQUIREMENTS EVALUATION

ITEM	CRITICALITY	SYSTEM/COMPONENT IDENTIFICATION	MAINT. LEVEL			MAINT. TYPE		LRU		SPARE REQD.		LEGEND:
			LEVEL I	LEVEL II	LEVEL III	SCHED.	UNSCHED.	YES	NO	YES	NO	
152	4	H <sub>2</sub> Leak Detector	X		X	X	X	X		X		Not evaluated at this level.
153	4	O <sub>2</sub> Analyzer	X		X	X	X	X		X		
154	4	N <sub>2</sub> H <sub>4</sub> Detector	X		X	X	X	X		X		
155	4	RGA	X		X	X	X	X		X		
156	4	Contamination Det.	X		X	X	X	X		X		
157	-	Elect. Pwr. & Distr. S/S	-	-	-	-	-	-	-	-	-	
158	4	Fuel Cells	X		X	X	X	X		X		
159	4	Battery	X	X		X		X		X		
160	3	Reactant Tank	X			X	X	X		X		
161	4	Power Proc. Unit	X	X		X	X	X		X		
162	4	Power Distributor	X	X		X	X	X		X		
163	4	Cont. Distributor	X	X		X	X	X		X		
164	3	F/C T/C Distributor	X	X		X	X	X		X		
165	3	Main Eng. Distributor	X	X		X	X	X		X		
166	3	APS Distributor	X	X		X	X	X		X		

## NOTES:

1. Due to the lack of design data at this early stage of the program, such maintenance data as operational life, MTBF and MTBR are based on Tug life requirements in lieu of actual design characteristics of the individual maintenance item.
2. Whenever it was suspected that maintenance items were similar or identical they were grouped on a common Tug Maintenance Requirements Data Sheet.

# YUG MAINTENANCE REQUIREMENTS DATA SHEET

<b>MAINTENANCE ITEM DATA</b>							
ITEM IDENTIFICATION: Forward Skirt				TABLE 5-1 REF: Item 2		FUNCTION NO. 2.7, 2.20 & 3.1	
SYSTEM: Structures		SUBSYSTEM: Bodyshell			CRITICALITY: 2		
FUNCTIONAL DESCRIPTION: Provides structural support for the spacecraft, docking mechanism, nonpropulsive vent system and portions of the avionics system.							
PHYSICAL DESCRIPTION: 176"Dia. x 61.25"long x 0.50" thick, honeycomb core with .010" graphite epoxy face sheet, weight = 239 pounds.							
TUG LOCATION: Station 935.99 thru 997.24		ACCESSIBILITY Adequate			LRU No		
<b>LIFE DATA</b>							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)	MTBR 6,720 Hrs.	
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: 1 Ship Set		
<b>MAINTENANCE DATA</b>							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On-condition
	X	X			X	X	
OFI REQUIREMENTS: Shock Accelerometers at attachment fitting Z3 (Z axis) and station 951.00 (X axis), for the purpose of monitoring docking and landing load measurements.							
<b>MAINTENANCE FUNCTIONS:</b> 1. SCHEDULED MAINTENANCE (LEVEL I) a. Visual inspection for evidence of cracks, delamination and structural deformation. b. Visual inspection for meteoroid damage. c. Visual inspection for thermal coating degradation. d. Review flight recorded data for evidence of structural over-load conditions. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. Repair in place anomalies noted during scheduled maintenance functions a through c. 3. UNSCHEDULED MAINTENANCE (LEVEL II) a. Perform radiographic inspection of the forward skirt if OFI data indicates over-load conditions, and repair as applicable.							
OTHER CONSIDERATIONS/REMARKS  None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Spacecraft Docking Mechanism				TABLE 5-1 REF: Item 3		FUNCTION NO. 2.7, 2.11 & 3.1	
SYSTEM: Structures		SUBSYSTEM: Forward Skirt		CRITICALITY: 3			
FUNCTIONAL DESCRIPTION: Provides structural mating interface for the deployment and retrieval of the spacecraft portion of the payload and provides docking shock impact attenuation.							
PHYSICAL DESCRIPTION: The spacecraft docking mechanism consists of a square spacecraft support frame, guides, capture latches and pneumatic/hydraulic shock absorber/actuators.							
TUG LOCATION: Front end of the Fwd. Skirt		ACCESSIBILITY Adequate		LRU Yes, at both the assembly and piece part levels.			
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES			SHELF LIFE: Indefinite	MTBF 4,000 Hrs. (Design Goal)	MTBR 6,720 Hrs.		
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On-condition
	X	X			X	X	
OFI REQUIREMENTS: Shock accelerometer attached to the spacecraft support frame in the X axis.							
MAINTENANCE FUNCTIONS: 1. SCHEDULED MAINTENANCE (LEVEL I) a. Visual inspection for evidence of cracks and/or structural deformation. b. Perform functional checkout ( extend/retract and latching ). c. Review flight recorded shock data for evidence of structural over-load conditions. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. Remove and replace damaged docking mechanism or subassembly. b. Remove and replace docking mechanism if OFI data indicates over-load condition. 3. UNSCHEDULED MAINTENANCE (LEVEL II) a. Perform radiographic inspection of removed docking mechanism and repair as applicable.							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Main Skirt				TABLE 5-1 REF: Item 4		FUNCTION NO. 2.7, 2.20 & 3.1	
SYSTEM: Structures		SUBSYSTEM: Bodyshell			CRITICALITY: 2		
FUNCTIONAL DESCRIPTION: Provides structural support for the LH <sub>2</sub> and LO <sub>2</sub> tanks, main engines, pressurization system, APS, and portions of the avionics system.							
PHYSICAL DESCRIPTION: 176"Dia. x 175.662"long x 0.50"thick, honeycomb core with 0.010" thick graphite epoxy face sheets, weight = 675 pounds.							
TUG LOCATION: Station 997.24 thru 1172.902		ACCESSIBILITY Adequate			LRU No		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)		MTBR 6,720 Hrs.
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On-condition
	X	X			X	X	
OFI REQUIREMENTS: Shock accelerometers at attachment fittings Z1 & Z2 (Z axis) and Y4 (X axis), also on the aft adapter attachment ring station 1172.902 (X axis).							
MAINTENANCE FUNCTIONS: 1. SCHEDULED MAINTENANCE (LEVEL I) a. Visual inspection for evidence of cracks, delaminations and structural deformation. b. Visual inspection for meteoroid damage. c. Visual inspection for thermal coating degradation. d. Review flight recorded shock data for evidence of structural over-load conditions. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. Repair in place anomalies noted during scheduled maintenance functions a through c. 3. UNSCHEDULED MAINTENANCE (LEVEL II) a. Perform radiographic inspection of the main skirt if OFI data indicates over-load conditions, and repair as applicable.							
OTHER CONSIDERATIONS REMARKS None							

# TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LH <sub>2</sub> Propellant Tank				TABLE 5-1 REF: Item 5		FUNCTION NO. 1.11, 2.3, 2.7, 3.1 & 4.8	
SYSTEM: Structures		SUBSYSTEM: Main Skirt			CRITICALITY: 2		
FUNCTIONAL DESCRIPTION: Provides fuel storage capability.							
PHYSICAL DESCRIPTION: 169.0"Dia. x 174.5"long with elliptical bulkheads, 1748 cubic feet capacity, weight = 424.94 pounds.							
TUG LOCATION: Station 937.49 thru 1111.99		ACCESSIBILITY At elliptical bulkheads only			LRU No		
LIFE DATA							
OPERATION LIFE: 8,400 Hrs. TIME 50 CYCLES			SHELF LIFE: Indefinite		MTBF 7,800 Hrs. (Design Goal)	MTSR N/A	
NO. TIMES REFURBISHABLE N/A		ANTICIPATED REFURB/100 FLIGHTS N/A			SPARES REQUIRED: N/A		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On-condition
	X				X	X	
OFI REQUIREMENTS: Baseline defined OFI adequate, also consider over-load OFI defined in item 4.							
MAINTENANCE FUNCTIONS: 1. SCHEDULED MAINTENANCE (LEVEL I) a. Flush and purge cleaning. b. Visual inspection of bulkheads for cracks and structural deformation. c. Leak check ( Pressure decay and mass spectrometer as applicable ). 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. If evidence of meteoroid impact, perform internal tank inspection ( visual or light ) for evidence of metal spalling, if detected perform proof pressure and leak test.							
OTHER CONSIDERATIONS/REMARKS During internal inspection if a penetration is detected the tank is non-reparable.							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LO <sub>2</sub> Propellant Tank				TABLE 5-1 REF: Item 6		FUNCTION NO. 2.2, 2.7, 3.1 & 4.7	
SYSTEM: Structures		SUBSYSTEM: Main Skirt			CRITICALITY: 2		
FUNCTIONAL DESCRIPTION: Provides oxidizer storage capability.							
PHYSICAL DESCRIPTION: 144.0"Dia. x 101.82 long ellipsoid, capacity of 640 cubic feet, weight = 243.3 pounds.							
TUG LOCATION: Station 1121.99 thru 1223.81			ACCESSIBILITY At tank ends only		LRU No		
LIFE DATA							
OPERATION LIFE: 8,400 Hrs. TIME 50 CYCLES			SHELF LIFE: Indefinite		MTBF 7,800 Hrs. (Design Goal)	MTBR N/A	
NO. TIMES REFURBISHABLE N/A			ANTICIPATED REFURB/100 FLIGHTS N/A		SPARES REQUIRED: N/A		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On-condition
	X				X	X	
OFI REQUIREMENTS: Same as item 5							
MAINTENANCE FUNCTIONS: Same as item 5							
OTHER CONSIDERATIONS/REMARKS Same as item 5							



## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LH <sub>2</sub> Tank Support				TABLE 5-1 REF: Item 7		FUNCTION NO. 2.7 & 3.1	
SYSTEM: Structures		SUBSYSTEM: LH <sub>2</sub> Tank			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides structural support for the LH <sub>2</sub> tank between the Main skirt and the applicable tank.							
PHYSICAL DESCRIPTION: 1.75" Dia. fiberglass struts with forward and aft titanium end flanges, weight = 2.87 pounds.							
TUG LOCATION: Approximately station 1061.74		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. 20 TIME CYCLES		SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)		MTBR 6,720 Hrs.	
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	X				X	X	
OFI REQUIREMENTS: Same as item 4							
MAINTENANCE FUNCTIONS: 1. SCHEDULED MAINTENANCE (LEVEL I) a. Visual inspection for evidence of cracks or structural deformation. b. Review flight recorded shock data for evidence of structural over-load conditions 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. Remove and replace support struts for anomalies detected during visual inspection of hardware or if OFI data indicates over-load conditions.							
OTHER CONSIDERATIONS/REMARKS Support struts are considered non-reparable items.							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LO <sub>2</sub> Tank Supports				TABLE 5-1 REF: Item 8		FUNCTION NO. 2.7 & 3.1	
SYSTEM: Structures		SUBSYSTEM: LO <sub>2</sub> Tank			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides structural support for the LO <sub>2</sub> tank between the Main skirt and the applicable tank.							
PHYSICAL DESCRIPTION: 2.0" Dia. fiberglass struts with forward and aft titanium end flanges, weight = 1.625 pounds.							
TUG LOCATION: Approximately station 1172.9		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. 20 TIME CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)	MTBR 6,720 Hrs.	
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On-condition
	X				X	X	
OFI REQUIREMENTS: Same as item 4							
MAINTENANCE FUNCTIONS: Same as item 7							
OTHER CONSIDERATIONS-REMARKS Same as item 7							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Thrust Structure				TABLE 5-1 REF: Item 9		FUNCTION NO. 2.7 & 3.1	
SYSTEM: Structures		SUBSYSTEM: Main Engine		CRITICALITY: 4			
FUNCTIONAL DESCRIPTION: Provides thrust transfer capability for main engine and in addition provides structural support for the engine.							
PHYSICAL DESCRIPTION: Open fiberglass truss conic frustrum with a 7" Dia. gimbal block and has a forward diameter of 91.0" and a length of 28.5", weight = 28.8 pounds.							
TUG LOCATION: Aft end I02 tank		ACCESSIBILITY Adequate		LRU Yes			
LIFE DATA							
OPERATION LIFE: 3,400 Hrs.      TIME      20      CYCLES		SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)		MTBR 6,720 Hrs.	
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5		SPARES REQUIRED: 1 Ship Set			
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	X				X	X	
OFI REQUIREMENTS: Provide strain gauges at 90° intervals to provide stress data during main engine firings and stress data during tug retrieval.							
MAINTENANCE FUNCTIONS: 1. SCHEDULED MAINTENANCE (LEVEL I) a. Visual inspection for evidence of cracks or structural deformation. b. Review flight recorded stress data for evidence of over-stress conditions. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. Remove and replace thrust structure for anomalies detected during visual inspection or if OFI data indicates over-stress conditions.							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION:				TABLE 5-1 REF:		FUNCTION NO.	
Aft Adapter				Item 10		2.13, 2.20 & 3.2	
SYSTEM:		SUBSYSTEM:			CRITICALITY:		
Structures		Bodyshell			2		
FUNCTIONAL DESCRIPTION: Provides the mechanically operated tug/deployment adapter latching system and supports the umbilical plates and the propellant drain and dump system including the helium purge provisions.							
PHYSICAL DESCRIPTION: 176.0" Dia. x 123.0" long bifurcated cylinder, weight = 506.3 pounds.							
TUG LOCATION:			ACCESSIBILITY			LRU	
Station 1172.9 thru 1295.9			Adequate			No	
LIFE DATA							
OPERATION LIFE:				SHELF LIFE:		MTBF	
3,400 Hrs. TIME 20 CYCLES				Indefinite		4,000 Hrs. (Design Goal)	
MTBR				6,720 Hrs.			
NO. TIMES REFURBISHABLE			ANTICIPATED REFURB/100 FLIGHTS			SPARES REQUIRED:	
18			2.5			1 Ship Set	
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	X	X			X	X	On-condition
O/FI REQUIREMENTS: Shock accelerometers at attachment fittings Z4 & Z5 (Z axis) and at station 1172.9 in the X axis.							
MAINTENANCE FUNCTIONS:							
1. SCHEDULED MAINTENANCE (LEVEL I) Same as item 2							
2. UNSCHEDULED MAINTENANCE (LEVEL I) Same as item 2							
3. UNSCHEDULED MAINTENANCE (LEVEL II) Same as item 2							
OTHER CONSIDERATIONS/REMARKS							
None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Aft Adapter Latching Mechanism				TABLE 5-1 REF: Item 11		FUNCTION NO. 2.13, 2.17 3.2 & 4.14	
SYSTEM: Structures		SUBSYSTEM: Aft Adapter		CRITICALITY: 4			
FUNCTIONAL DESCRIPTION: Provides latching capability for mating the tug to the aft adapter during deployment and retrieval of the tug.							
PHYSICAL DESCRIPTION: Motor driven rack and pinion, and latching mechanism, detailed physical description TBS. Weight = 10.625 pounds.							
TUG LOCATION: Approximately station 1172.9		ACCESSIBILITY Adequate		LRU Yes			
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES			SHELF LIFE: Indefinite	MTBF TBS	MTBR TBS		
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS TBS		SPARES REQUIRED: 1 Ship Set			
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition-Monitoring
	X	X			X	X	
OFI REQUIREMENTS: Current signature of motor every time mechanism is operated							
MAINTENANCE FUNCTIONS:							
1. SCHEDULED MAINTENANCE (LEVEL I) a. Review flight current signature data to determine mission performance characteristics, establish trend analysis to determine long term degradation. b. Visual inspection of mechanical parts for wear and/or structural deformation. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. Remove and replace latching mechanism demonstrating evidence of wear or motor performance failure or degradation. 3. UNSCHEDULED MAINTENANCE (LEVEL II) a. Repair failed or degraded latching mechanism as applicable.							
OTHER CONSIDERATIONS/REMARKS None							

# TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Main Engine				TABLE 5-1 REF: Item 13		FUNCTION NO. 2.7, 2.10, 2.11, 2.12 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Main Engine		CRITICALITY: 2			
FUNCTIONAL DESCRIPTION: Provides for a vacuum thrust of 15,000 pounds, with a specific impulse of 456.5 seconds, at a chamber pressure of 400 psia. Rated for five hours operation with 190 starts for all major mission V maneuvers, and 3,750 pounds for small V maneuvers.							
PHYSICAL DESCRIPTION: The main engine is a Pratt & Whitney RL10 derivative IIB engine with a 40" primary nozzle dia. and a 70.75" dia. nozzle extension. The overall length with nozzle retracted/extended is 55" and 110" respectively, weight = 442 pounds.							
TUG LOCATION: Aft . . . . .		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 5.0 Hrs. TIME 5 CYCLES			SHELF LIFE: Indefinite		MTBF 6.0 Hrs.	MTBR 5.0 Hrs (sched)	
NO. TIMES REFURBISHABLE 4		ANTICIPATED REFURB/100 FLIGHTS 20			SPARES REQUIRED: TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition - Monitoring
	X	X			X	X	
OFI REQUIREMENTS. Baseline defined OFI appears to be adequate with the addition of current signatures for all solenoid actuated valves.							
MAINTENANCE FUNCTIONS: 1. SCHEDULED MAINTENANCE (LEVEL I) a. Visual inspection for the overall engine and components, turbo pump torque checks, inlet valves and internal leak check of purge system. b. Review OFI data to determine necessity to remove and replace failed or degraded components. c. Perform pre-maintenance fault isolation test to determine health of components not monitored by OFI. d. Remove and replace main engine assembly after every five missions. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. Remove and replace all components/engine assembly indicating failure or degradation based on OFI data or pre-maintenance testing. b. Perform functional testing to verify integrity of replaced component or assembly.							
OTHER CONSIDERATIONS-REMARKS See attached sheet for remainder of maintenance functions.							

SUPPLIMENTAL SHEET FOR ITEM 13

MAINTENANCE FUNCTIONS: ( continued )

3. SCHEDULED MAINTENANCE (LEVEL II)

- a. Overhaul or repair main engine assembly as required after scheduled removal.
- b. Performed post maintenance functional test and return to storage.

4. UNSCHEDULED MAINTENANCE (LEVEL II)

- a. Overhaul or repair main engine assembly or component as applicable after unscheduled maintenance requiring removal as a function of OFI data or pre-maintenance testing.
- b. After repair perform functional testing and return to storage.

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Propellant (F&D) Solenoid Control Valves				TABLE 5-1 REF: Item 15		FUNCTION NO. 2.1, 2.10, 2.11 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Fill, Feed, Drain & Vent			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides control pressure for pneumatic actuated valves.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Intertank		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 HRS TIME 20 CYCLES				SHELF LIFE: Indefinite	MTBF 4,000 Hrs. (Design Goal)	MTBR 6,720 Hrs.	
NO. TIMES REFURBISHABLE N/A		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: TBS		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition- Monitoring
	X	X			X	X	
OFI REQUIREMENTS: Continuous current signature monitoring for each actuation during flight operation.							
MAINTENANCE FUNCTIONS: 1. SCHEDULED MAINTENANCE (LEVEL I) a. Review flight OFI data for evidence of failure or performance degradation. b. Perform leakage test as a part of system leak test. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. Remove and replace valves if flight data displays evidence of degradation or failure as a function of current signature deviations or if trend data shows a failure is imminent. b. After replacement perform functional and leak checks on replaced valve. 3. UNSCHEDULED MAINTENANCE (LEVEL II) a. Repair removed valve as applicable, test and return to storage.							
OTHER CONSIDERATIONS/REMARKS None							



## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION LH <sub>2</sub> Fill and Drain Valve				TABLE 5-1 REF: Item 16		FUNCTION NO. 2.1, 2.10, 2.11 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Fill, Feed, Drain & Vent			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides ground operations fill and drain capability for LH <sub>2</sub> .							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Aft Skirt		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)	MTBR 6,720 Hrs.	
NO. TIMES REFURBISHABLE N/A		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition - Monitoring
	X	X			X	X	
OFI REQUIREMENTS: Not required valve used during ground operations only.							
MAINTENANCE FUNCTIONS: 1. SCHEDULED MAINTENANCE (LEVEL I) a. Tug safing requirements will serve as functional verification of this valve, after demate of the tug from the orbiter perform visual inspection of the valve for evidence of deformation. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. If during fill or drain operations valve demonstrates evidence of performance degradation, remove and replace, perform functional and leak check of the replaced valve. 3. UNSCHEDULED MAINTENANCE (LEVEL II) a. Repair failed valve as applicable, test and leak check and return to storage.							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LH <sub>2</sub> Horizontal Dump Valve				TABLE 5-1 REF: Item 17		FUNCTION NO. 2.1, 2.10, 2.11 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Fill, Feed, Drain & Vent			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides LH <sub>2</sub> dump capability in the event of an aborted mission with dump being accomplished with orbiter in a landed configuration. Further, provides standby backup for the fill, drain and prevalue in the event of a flight failure of this valve.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: LH <sub>2</sub> Tank		ACCESSIBILITY Inadequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES				SHELF LIFE: Indefinite		MTBF 1,000 Hrs.	
						MTBR 1,000 Hrs.	
NO. TIMES REFURBISHABLE 10		ANTICIPATED REFURB/100 FLIGHTS 30			SPARES REQUIRED: TBS		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition - Monitoring
	X	X			X	X	
OFI REQUIREMENTS: Proximity Pickup.							
MAINTENANCE FUNCTIONS:							
1. SCHEDULED MAINTENANCE (LEVEL I) a. Review flight OFI data for evidence of failure or performance degradation. b. Perform leakage test as a part of the system leak test. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. Remove and replace if flight data indicates performance degradation or failure. b. After replacement perform functional and leak test on replaced valve. 3. UNSCHEDULED MAINTENANCE (LEVEL II) a. Repair removed valve as applicable, test and return to storage.							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LH <sub>2</sub> Fill, Drain and Prevalve				TABLE 5-1 REF: Item 18		FUNCTION NO. 2.1, 2.10, 2.11 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Fill, Feed, Drain & Vent		CRITICALITY: 4			
FUNCTIONAL DESCRIPTION: Provides the function of fill, drain and acts as a pre valve for LH <sub>2</sub> propellant system, and provides a backup system for the horizontal dump valve in the event of a failure of the dump valve.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: LH <sub>2</sub> Tank		ACCESSIBILITY Inadequate		LRU Yes			
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES			SHELF LIFE: Indefinite	MTBF 1,000 Hrs.	MTBR 1,000 Hrs.		
NO. TIMES REFURBISHABLE 10		ANTICIPATED REFURB/100 FLIGHTS 30		SPARES REQUIRED: TBS			
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition - Monitoring
	X	X			X	X	
OFI REQUIREMENTS: Proximity Pickup							
MAINTENANCE FUNCTIONS: Same as Item 17							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION:				TABLE 5-1 REF:		FUNCTION NO.	
LH <sub>2</sub> Coupler				Item 19		2.1, 2.7, 2.10 & 3.1	
SYSTEM:		SUBSYSTEM:		CRITICALITY:			
Propulsion		Fill, Feed, Drain & Vent		4			
FUNCTIONAL DESCRIPTION: Provides interface connection capability for the orbiter LH <sub>2</sub> Fill & Drain flex line.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION:		ACCESSIBILITY			LRU		
Aft Skirt		Adequate			Yes		
LIFE DATA							
OPERATION LIFE:			SHELF LIFE:		MTBF	MTBR	
3,400 Hrs. TIME 20 CYCLES			Indefinite		4,000 Hrs. (Design Goal)	6,720 Hrs.	
NO. TIMES REFURBISHABLE			ANTICIPATED REFURB/100 FLIGHTS		SPARES REQUIRED:		
18			2.5		1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	X				X	X	
OFI REQUIREMENTS:							
None							
MAINTENANCE FUNCTIONS:							
1. SCHEDULED MAINTENANCE (LEVEL I) a. Visual inspection for evidence of surface scoring and seal degradation. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. Remove and replace with new coupler.							
OTHER CONSIDERATIONS/REMARKS							
None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LH <sub>2</sub> Flex Line				TABLE 5-1 REF: Item 20		FUNCTION NO. 2.1, 2.7, 2.10 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Fill, Feed, Drain & Vent			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides LH <sub>2</sub> transfer capability from the coupler to the LH <sub>2</sub> Fill and Drain valve.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Aft Skirt		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)		MTBR 6,720 Hrs.
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On - Condition
	X				X	X	
OFI REQUIREMENTS: None							
MAINTENANCE FUNCTIONS: Same as item 19							
OTHER CONSIDERATIONS: REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LH <sub>2</sub> Quick Disconnect				TABLE 5-1 REF: Item 21		FUNCTION NO. 2.1, 2.7, 2.10 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Fill, Feed, Drain & Vent			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides interface connection capability between the Aft Adapter and the umbilical panel on the tug.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Aft Adapter		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)	MTBR 6,720 Hrs.	
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: Yes		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE  On - Condition
	X				X	X	
OFI REQUIREMENTS: None							
MAINTENANCE FUNCTIONS:  1. SCHEDULED MAINTENANCE (LEVEL I) a. Visual inspection of QD for evidence of surface scoring or seal degradation and perform leakage test as part of system leak test. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. Remove and replace with new QD and leak test.							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LH <sub>2</sub> Vertical Vent Valve				TABLE 5-1 REF: Item 22		FUNCTION NO. 2.1, 2.10, 2.11 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Fill, Feed, Drain & Vent			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides venting capability when the LH <sub>2</sub> tank is in the vertical position.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: LH <sub>2</sub> Tank		ACCESSIBILITY Inadequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES				SHELF LIFE: Indefinite		MTBF 1,000 Hrs.	
						MTBR 1,000 Hrs.	
NO. TIMES REFURBISHABLE 10		ANTICIPATED REFURB/100 FLIGHTS 30			SPARES REQUIRED: TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition - Monitoring
	X	X			X	X	
OFI REQUIREMENTS: Proximity Pickup							
MAINTENANCE FUNCTIONS: Same as item 17							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LH <sub>2</sub> Horizontal Vent Valve				TABLE 5-1 REF: Item 23		FUNCTION NO. 2.1, 2.10, 2.11 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Fill, Feed, Drain & Vent			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides venting capability when the LH <sub>2</sub> tank is in the horizontal position.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: LH <sub>2</sub> Tank		ACCESSIBILITY Inadequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES				SHELF LIFE: Indefinite		MTBF 1,000 Hrs.	
						MTBR 1,000 Hrs.	
NO. TIMES REFURBISHABLE 10		ANTICIPATED REFURB/100 FLIGHTS 30			SPARES REQUIRED: TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition - Monitoring
	X	X			X	X	
OFI REQUIREMENTS: Proximity Pickup							
MAINTENANCE FUNCTIONS: Same as item 17							
OTHER CONSIDERATIONS/REMARKS None							



## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LH <sub>2</sub> Thermodynamic Vent				TABLE 5-1 REF: Item 24		FUNCTION NO. 2.1, 2.10, 2.11 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Fill, Feed, Drain & Vent			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides zero gravity thermodynamic venting of gas only when Both gas and liquid are present.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: LH <sub>2</sub> Tank		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs TIME 20 CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)		MTBR 6,720 Hrs.
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	X	X			X	X	
Condition - Monitoring							
OFI REQUIREMENTS: Outlet temperature probe and liquid sensor.							
MAINTENANCE FUNCTIONS: 1. SCHEDULED MAINTENANCE (LEVEL I) a. Review flight OFI data for evidence of failure or performance degradation. b. Perform leakage test as a part of the system leak test. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. Remove and replace thermodynamic vent if OFI data indicates a failure or performance degradation. b. After replacement perform functional and leak test of the replaced vent. 3. UNSCHEDULED MAINTENANCE (LEVEL II) a. Repair removed vent as applicable, test and return to storage.							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LO <sub>2</sub> Fill, Drain & Dump Valve				TABLE 5-1 REF: Item 25		FUNCTION NO. 2.1, 2.10, 2.11 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Fill, Feed, Drain & Vent			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides ground operations fill and drain capability for LO <sub>2</sub> and airborne dump capability in the event of post launch abort.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Aft Shirt			ACCESSIBILITY Adequate			LRU Yes	
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES				SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)	
						MTBF 6,720 Hrs.	
NO. TIMES REFURBISHABLE 18			ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: 1 Ship Set	
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE  Condition - Monitoring
	X	X			X	X	
OFI REQUIREMENTS: Proximity pickup							
MAINTENANCE FUNCTIONS: Same as item 16							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LO <sub>2</sub> Prevalve				TABLE 5-1 REF: Item 26		FUNCTION NO. 2.1, 2.10, 2.11 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Fill, Feed, Drain & Vent			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides the capability of control of feed of LO <sub>2</sub> to the main engine during mission engine firings.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Intertank		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES			SHELF LIFE: Indefinite	MTBF 4,000 Hrs. (Design Goal)	MTBR 6,720 Hrs.		
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE  Condition - Monitoring
	X	X			X	X	
OFI REQUIREMENTS: Proximity pickup							
MAINTENANCE FUNCTIONS:  Same as item 17							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LO <sub>2</sub> Coupler				TABLE 5-1 REF: Item 27		FUNCTION NO. 2.1, 2.7, 2.10 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Fill, Feed, Drain & Vent			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides interface connection capability for the orbiter LO <sub>2</sub> Fill & Drain flex line.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Aft Skirt		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)	MTBR 6,720 Hrs.	
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE  On - Condition
	X				X	X	
OFI REQUIREMENTS:  None							
MAINTENANCE FUNCTIONS:  Same as item 19							
OTHER CONSIDERATIONS/REMARKS  None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LO <sub>2</sub> Flex Line				TAB E 5-1 REF: Item 28		FUNCTION NO. 2.1, 2.7, 2.10 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Fill, Feed, Drain & Vent			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides LO <sub>2</sub> transfer capability from the coupler to the LO <sub>2</sub> Fill and Drain Valve.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Aft Skirt		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)		MTBR 6,720 Hrs.
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On - Condition
	X				X	X	
OFI REQUIREMENTS: None							
MAINTENANCE FUNCTIONS: Same as item 19							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LO <sub>2</sub> Quick Disconnect				TABLE 5-1 REF: Item 29		FUNCTION NO. 2.1, 2.7, 2.10 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Fill, Feed, Drain & Vent			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides interface connection capability between the Aft Adapter and the umbilical panel on the tug.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Aft Adapter		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs TIME 20 CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)	MTBR 6,720 Hrs.	
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On - Condition
	X				X	X	
OFI REQUIREMENTS: Same as item 21							
MAINTENANCE FUNCTIONS: Same as item 21							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LO Solenoid Control Vent Valve 2				TABLE 5-1 REF: Item 30		FUNCTION NO. 2.1, 2.10, 2.11 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Fill, Feed, Drain & Vent			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides control pressure for pneumatic valves.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Intertank		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 4,400 Hrs. TIME 20 CYCLES				SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)	
						MTBR 6,720 Hrs.	
NO. TIMES REFURBISHABLE N/A		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition - Monitoring
	X	X			X	X	
OFI REQUIREMENTS: Continious current signature monitoring for each actuation during flight operation.							
MAINTENANCE FUNCTIONS:  Same as item 15							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA									
ITEM IDENTIFICATION:					TABLE 5-1 REF:		FUNCTION NO.		
LO <sub>2</sub> Vent Valve					Item 31		2.1, 2.10, 2.11 & 3.1		
SYSTEM:			SUBSYSTEM:			CRITICALITY:			
Propulsion			Fill, Feed, Drain & Vent			4			
FUNCTIONAL DESCRIPTION: Provides venting capability for the LO <sub>2</sub> tank.									
PHYSICAL DESCRIPTION:									
TBS									
TUG LOCATION:			ACCESSIBILITY			LRU			
Intertank			Adequate			Yes			
LIFE DATA									
OPERATION LIFE:				SHELF LIFE:		MTBF		MTBR	
3,400 Hrs. 20				Indefinite		4,000 Hrs.		6,720 Hrs.	
TIME CYCLES						(Design Goal)			
NO. TIMES REFURBISHABLE			ANTICIPATED REFURB/100 FLIGHTS			SPARES REQUIRED:			
18			2.5			TBD			
MAINTENANCE DATA									
MAINTENANCE LEVEL		I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE	
		X	X			X	X		
Condition - Monitoring									
OFI REQUIREMENTS									
Proximity pickup									
MAINTENANCE FUNCTIONS:									
Same as item 17									
OTHER CONSIDERATIONS/REMARKS									
None									



## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LO <sub>2</sub> Thermodynamic Vent				TABLE 5-1 REF: Item 32		FUNCTION NO. 2.1, 2.10, 2.11 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Fill, Feed, Drain & Vent			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides zero gravity thermodynamic venting of gas only when both gas and liquid are present.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: LO <sub>2</sub> Tank		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES				SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)	
						MTBR 6,720 Hrs.	
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition - Monitoring
	X	X			X	X	
OFI REQUIREMENTS: Same as item 24							
MAINTENANCE FUNCTIONS: Same as item 24							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LH <sub>2</sub> Fill and Drain Plumbing				TABLE 5-1 REF: Item 33		FUNCTION NO. 2.1, 2.7 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Fill, Feed, Drain & Vent			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides all the plumbing interconnection for the LH <sub>2</sub> Fill, Feed and Drain Subsystem.							
PHYSICAL DESCRIPTION: 2.25" diameter aluminum insulated pipes with steel vacuum jacketed bellows joints.							
TUG LOCATION: LH <sub>2</sub> Tank, Intertank and Aft Skirt			ACCESSIBILITY Adequate		LRU No		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs.      20      CYCLES			SHELF LIFE: N/A		MTBF N/A		
MTBR N/A							
NO. TIMES REFURBISHABLE N/A			ANTICIPATED REFURB/100 FLIGHTS 1.0		SPARES REQUIRED: No		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On - Condition
	X				X	X	
OFI REQUIREMENTS: None							
MAINTENANCE FUNCTIONS: 1. SCHEDULED MAINTENANCE (LEVEL I) a. Visual inspection for evidence of cracks, leaks and structural deformation, and leak test as a part of the system leak test. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. If a leak is detected repair in place, and perform proof and leak test.							
OTHER CONSIDERATIONS/REMARKS:  None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION:				TABLE 5-1 REF:		FUNCTION NO.	
LH <sub>2</sub> Vent Plumbing				Item 34		2.1, 2.7 & 3.1	
SYSTEM:		SUBSYSTEM:			CRITICALITY:		
Propulsion		Fill, Feed, Drain & Vent			4		
FUNCTIONAL DESCRIPTION: Provides all the plumbing interconnection for the LH <sub>2</sub> Vent subsystem.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION:		ACCESSIBILITY			LRU		
Fwd. Skirt and Intertank		Adequate			No		
LIFE DATA							
OPERATION LIFE:			SHELF LIFE:		MTBF		MTBR
3,400 Hrs. TIME 20 CYCLES			N/A		N/A		N/A
NO. TIMES REFURBISHABLE		ANTICIPATED REFURB/100 FLIGHTS			SPARES REQUIRED:		
N/A		1.0			No		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	X				X	X	
OFI REQUIREMENTS:							
None							
MAINTENANCE FUNCTIONS:							
Same as item 33							
OTHER CONSIDERATIONS/REMARKS							
None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LO <sub>2</sub> Fill and Drain Plumbing				TABLE 5-1 REF: Item 35		FUNCTION NO. 2.1, 2.7 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Fill, Feed, Drain & Vent			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides all plumbing interconnections for the LO <sub>2</sub> Fill, Feed and Drain subsystem.							
PHYSICAL DESCRIPTION: 3.0" diameter aluminum insulated pipes with steel vacuum jacketed bellows joints.							
TUG LOCATION: Intertank and Aft Skirt		ACCESSIBILITY Adequate			LRU No		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs.      20      TIME      CYCLES			SHELF LIFE: N/A		MTBF N/A		
					MTBR N/A		
NO. TIMES REFURBISHABLE N/A		ANTICIPATED REFURB/100 FLIGHTS 1.0			SPARES REQUIRED: No		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On - Condition
	X				X	X	
OFI REQUIREMENTS: None							
MAINTENANCE FUNCTIONS: Same as item 33							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LO <sub>2</sub> Vent Plumbing				TABLE 5-1 REF: Item 36		FUNCTION NO. 2.1, 2.7 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Fill, Feed, Drain & Vent			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides all the plumbing interconnection for the LO <sub>2</sub> Vent subsystem.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Intertank and Aft Skirt		ACCESSIBILITY Adequate			LRU No		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs.      20 TIME                      CYCLES			SHELF LIFE: N/A		MTBF N/A		MTBR N/A
NO. TIMES REFURBISHABLE N/A		ANTICIPATED REFURB/100 FLIGHTS 1.0			SPARES REQUIRED: No		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE  On - Condition
	X				X	X	
OFI REQUIREMENTS: None							
MAINTENANCE FUNCTIONS: Same as item 33							
OTHER CONSIDERATIONS REMARKS  None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Pneumatic Plumbing				TABLE 5.1 REF: Item 37		FUNCTION NO. 2.1, 2.7 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Fill, feed, Drain & Vent			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides all the pneumatic pressure lines in support of the Fill, Feed, Drain & Vent subsystem pneumatic actuated valves.							
PHYSICAL DESCRIPTION: Various $\frac{1}{4}$ and $\frac{1}{2}$ " diameter aluminum tubing.							
TUG LOCATION: Fwd. Skirt, Intertank, Aft Skirt and Aft Adapter			ACCESSIBILITY Adequate		LRU No		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs.      20      CYCLES			SHELF LIFE: N/A		MTBF N/A		
NO. TIMES REFURBISHABLE N/A			ANTICIPATED REFURB/100 FLIGHTS 1.0		SPARES REQUIRED: No		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On - Condition
	X				X	X	
OFI REQUIREMENTS: None							
MAINTENANCE FUNCTIONS: Same as item 33							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Helium Sphere				TABLE 5.1 REF: Item 39 & 81		FUNCTION NO. 2.1, 2.7 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Pressurization			CRITICALITY: 3		
FUNCTIONAL DESCRIPTION: Provides Helium storage capability for propellant tank pressurization, purge and Purge bag pressure blanket.							
PHYSICAL DESCRIPTION: 4.5 ft <sup>3</sup> , 3200 psia spheres having an approximate diameter of 29 inches.							
TUG LOCATION: Intertank and Aft Adapter		ACCESSIBILITY Inadequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)		MTBR 6,720 Hrs.
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition - Monitoring
	X				X	X	
OFI REQUIREMENTS: Pressure transducer							
MAINTENANCE FUNCTIONS:							
1. SCHEDULED MAINTENANCE (LEVEL I) <ul style="list-style-type: none"> <li>a. Review flight OFI for evidence of failure or structure degradation.</li> <li>b. Visual inspection of helium spheres for evidence of structural damage, and perform leak test.</li> </ul> 2. UNSCHEDULED MAINTENANCE (LEVEL I) <ul style="list-style-type: none"> <li>a. If the flight OFI data or visual inspection/leak test detects a failure or evidence of performance degradation, remove and replace the helium sphere.</li> </ul>							
OTHER CONSIDERATIONS-REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Pressurization Solenoid Control Valve				TABLE 5-1 REF: Item 40		FUNCTION NO. 2.1, 2.10, 2.11 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Pressurization			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides pneumatic pressure for control pneumatic actuated valves contained in the pressurization subsystem.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Intertank, Aft Skirt and Aft Adapter			ACCESSIBILITY Adequate			LRU Yes	
LIFE DATA							
OPERATION LIFE: 3,400 Hrs.      20 TIME                   CYCLES				SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)	
MTBR 6,720 Hrs.							
NO. TIMES REFURBISHABLE 18			ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: TBD	
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition - Monitoring
	X	X			X	X	
OFI REQUIREMENTS: Continious current signature monitoring for each actuation during flight operation.							
MAINTENANCE FUNCTIONS: Same as item 15							
OTHER CONSIDERATIONS/REMARKS None							



# TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA						
ITEM IDENTIFICATION: Pressurization Helium Regulator				TABLE 5-1 REF. Item 41 & 78		FUNCTION NO. 2.1, 2.10, 2.11 & 3.1
SYSTEM: Propulsion		SUBSYSTEM: Pressurization			CRITICALITY: 4	
FUNCTIONAL DESCRIPTION: Provides output pressure regulation from the helium storage spheres at appropriate levels for purge and/or pressurization.						
PHYSICAL DESCRIPTION: TBS						
TUG LOCATION: Intertank and Aft Adapter		ACCESSIBILITY Adequate			LRU Yes	
LIFE DATA						
OPERATION LIFE: 3,400 Hrs.      20 TIME                   CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)	
MTBR 6,720 Hrs.						
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB. 100 FLIGHTS 2.5			SPARES REQUIRED: TBD	
MAINTENANCE DATA						
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD
	X				X	X
PRIMARY TECHNIQUE Condition - Monitoring						
OFI REQUIREMENTS: Pressure Transducer at outlet of regulator.						
MAINTENANCE FUNCTIONS: 1. SCHEDULED MAINTENANCE (LEVEL I) a. Review flight OFI data for evidence of failure or performance degradation. b. Perform leakage test as apart of the system leak test. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. If flight OFI data or the results of the leak test indicate failure or evidence of performance degradation, remove and replace the regulator, and perform leak testing.						
OTHER CONSIDERATIONS REMARKS None						

## TUG MAINTENANCE REQUIREMENTS DATA S. LET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Helium Filter				TABLE 5-1 REF: Item 42		FUNCTION NO. 2.1, 2.10, 2.11 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Pressurization			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides filtering on the output of the helium spheres to prevent introduction of contaminants into the propellant tanks or into the purge and pneumatic subsystems.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Intertank and Aft Adapter			ACCESSIBILITY Adequate		LRU Yes		
LIFE DATA							
OPERATION LIFE: 1,320 Hrs. TIME 5 CYCLES			SHELF LIFE: Indefinite		MTBF 1,320 Hrs.	MTBR After 5 Flights	
NO. TIMES REFURBISHABLE 3			ANTICIPATED REFURB/100 FLIGHTS 20		SPARES REQUIRED: TED		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Time
	X				X	X	
OFI REQUIREMENTS: None							
MAINTENANCE FUNCTIONS: 1. SCHEDULED MAINTENANCE (LEVEL I) a. After every 5th flight remove and replace the filter assemblies. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. Any time the helium pressure system is opened for maintenance purposes, remove and replace the filter assemblies after completion of system blowdown.							
OTHER CONSIDERATIONS/REMARKS None							

# TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Helium Vent Valve				TABLE 5-1 REF: Item 43 & 75		FUNCTION NO. 2.1, 2.10, 2.11 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Pressurization			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides helium venting capability in the event of helium system overpressure or failure of the helium pressure regulators.							
PHYSICAL DESCRIPTION:  TBS							
TUG LOCATION: Intertank and Aft Adapter		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs.      20 TIME                      CYCLES				SHELF LIFE: Indefinite		MTBF 4,000 Hrs.	
						MTBR 6,720 Hrs.	
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE  Condition - Monitoring
	X	X			X	X	
OFI REQUIREMENTS: Proximity pickup							
MAINTENANCE FUNCTIONS:  Same as item 17							
OTHER CONSIDERATIONS REMARKS  None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Helium Quick Disconnect				TABLE 5-1 REF: Item 44,76 & 80		FUNCTION NO. 2.1, 2.7 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Pressurization			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides ground operations connections for the purpose pressurization of the helium spheres.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Aft Skirt		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs.      20 TIME      CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)	MTBR 6,720 Hrs.	
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE  On - Condition
	X				X	X	
OFI REQUIREMENTS: None							
MAINTENANCE FUNCTIONS: Same as item 21							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Helium Coupler				TABLE 5-1 REF: Item 45		FUNCTION NO. 2.1, 2.7 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Pressurization		CRITICALITY: 4			
FUNCTIONAL DESCRIPTION: Provides interface connection capability for the orbiter Helium Fill and vent service connections.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Aft Adapter		ACCESSIBILITY Adequate		LRU Yes			
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES		SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)		MTBR 6,720 Hrs.	
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5		SPARES REQUIRED: 1 Ship Set			
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	X				X	X	
OFI REQUIREMENTS: None							
MAINTENANCE FUNCTIONS: Same as item 19							
OTHER CONSIDERATIONS REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Helium Plumbing				TABLE 5-1 REF: Item 46		FUNCTION NO. 2.1, 2.7 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Pressurization			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Same as Item 37							
PHYSICAL DESCRIPTION:							
TUG LOCATION:		ACCESSIBILITY			LRU		
LIFE DATA							
OPERATION LIFE:			SHELF LIFE:		MTBF		
TIME		CYCLES				MTBR	
NO. TIMES REFURBISHABLE			ANTICIPATED REFURB/100 FLIGHTS			SPARES REQUIRED:	
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
OFI REQUIREMENTS:							
MAINTENANCE FUNCTIONS							
OTHER CONSIDERATIONS/REMARKS							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Actuator Assembly				TABLE 5-1 REF: Item 48		FUNCTION NO. 2.10, 2.11, 3.1, 4.18 & 4.43	
SYSTEM: Propulsion		SUBSYSTEM: Hydraulics			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: The actuator assemblies provide pitch and yaw control during main engine firing, with a total gimbal capability of $\pm 5^\circ$ including $1^\circ$ snubbing, at a rate of $5^\circ$ / second.							
PHYSICAL DESCRIPTION:  TBS							
TUG LOCATION: Aft Skirt		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)	MTBR 2,800 Hrs.	
NO. TIMES REFURBISHABLE 10		ANTICIPATED REFURB 100 FLIGHTS 6.0			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE  Condition - Monitoring
	X	X			X	X	
OFI REQUIREMENTS: Appropriate transducers for command response, gimbal rate, position and acceleration.							
MAINTENANCE FUNCTIONS: 1. SCHEDULED MAINTENANCE (LEVEL I) a. Review flight OFI data for evidence of performance degradation or failure in redundant circuits. b. Perform functional and alignment testing. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. If OFI flight data indicates anomalies remove and replace the actuator assembly, perform functional and alignment testing. 3. UNSCHEDULED MAINTENANCE (LEVEL II) a. Repair malfunctioned actuator assembly as applicable, test, and return to storage.							
OTHER CONSIDERATIONS REMARKS  None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA								
ITEM IDENTIFICATION:				TABLE 5-1 REF:		FUNCTION NO.		
Main Hydraulic Pump				Item 49		2.10, 2.11 & 3.1		
SYSTEM:		SUBSYSTEM:			CRITICALITY:			
Propulsion		Hydraulic			4			
FUNCTIONAL DESCRIPTION: Provides hydraulic power to the TVC actuators during main engine firings.								
PHYSICAL DESCRIPTION:								
TBS								
TUG LOCATION:			ACCESSIBILITY			LRU		
Intertank			Adequate			Yes		
LIFE DATA								
OPERATION LIFE:				SHELF LIFE:		MTBF	MTBR	
3,400 Hrs. TIME 20 CYCLES				Indefinite		4,000 Hrs. (design goal)	6,720 Hrs.	
NO. TIMES REFURBISHABLE			ANTICIPATED REFURB/100 FLIGHTS			SPARES REQUIRED:		
18			1.0			TBD		
MAINTENANCE DATA								
MAINTENANCE LEVEL		I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
		X	X			X	X	
OFI REQUIREMENTS:								
Pressure transducer on the output of the pump assembly, and flow rate measurements.								
MAINTENANCE FUNCTIONS:								
1. SCHEDULED MAINTENANCE (LEVEL I) a. Review flight OFI for evidence of failure or performance degradation. b. Perform functional testing. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. If OFI flight data indicates failure or performance degradation, remove and replace pump assembly and perform functional testing. 3. UNSCHEDULED MAINTENANCE (LEVEL II) a. Repair pump assembly as applicable, test and return to storage.								
OTHER CONSIDERATIONS/REMARKS								
None								



# TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA						
ITEM IDENTIFICATION: Auxiliary Hydraulic Pump				TABLE 5-1 REF: Item 50		FUNCTION NO. 2.10, 2.11 & 3.1
SYSTEM: Propulsion		SUBSYSTEM: Hydraulic			CRITICALITY: 4	
FUNCTIONAL DESCRIPTION: Provides hydraulic pressure for actuators during low thrust main engine firings, and provides backup for main pump.						
PHYSICAL DESCRIPTION: TBS						
TUG LOCATION: Intertank		ACCESSIBILITY Adequate			LRU Yes	
LIFE DATA						
OPERATION LIFE: 3,400 Hrs.      20      CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)	
MTBR 6,720 Hrs.						
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 1.0			SPARES REQUIRED: TBD	
MAINTENANCE DATA						
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	TCHD	UNSCHD
	X	X			X	X
OFL REQUIREMENTS: Same as item 49, plus current signature for pump motor.						
MAINTENANCE FUNCTIONS:  Same as item 49						
OTHER CONSIDERATIONS/REMARKS  None						

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION:				TABLE 5-1 REF:		FUNCTION NO.	
Hydraulic Check Valve				Item 51		2.10, 2.11, 3.1 & 4.43	
SYSTEM:		SUBSYSTEM:		CRITICALITY:			
Propulsion		Hydraulic		4			
FUNCTIONAL DESCRIPTION: Provides hydraulic fluid flow direction as function of which hydraulic pump is operating.							
PHYSICAL DESCRIPTION:							
TBS							
TUG LOCATION:		ACCESSIBILITY			LRU		
Intertank and Aft Skirt		Adequate			Yes		
LIFE DATA							
OPERATION LIFE:			SHELF LIFE:		MTBF		MTBR
3,400 Hrs. TIME 20 CYCLES			Indefinite		4,000 Hrs. (Design Goal)		6,720 Hrs.
NO. TIMES REFURBISHABLE		ANTICIPATED REFURB/100 FLIGHTS			SPARES REQUIRED:		
18		1.0			TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	X	X			X	X	
OFI REQUIREMENTS:							
Proximity pickup to determine valve position during pump operations.							
MAINTENANCE FUNCTIONS:							
1. SCHEDULED MAINTENANCE (LEVEL I)							
a. Review flight OFI data to determine if a failure or performance degradation has occurred.							
b. Functional test as a part of the TVC system level test.							
2. UNSCHEDULED MAINTENANCE (LEVEL I)							
a. If an anomaly is detected remove and replace the valve, perform leak test and performance test.							
3. UNSCHEDULED MAINTENANCE (LEVEL II)							
a. repair valve as applicable, test and return to storage.							
OTHER CONSIDERATIONS/REMARKS							
None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Solenoid Sequence Valve				TABLE 5-1 REF: Item 52		FUNCTION NO. 2.10, 2.11, 3.1 & 4.43	
SYSTEM: Propulsion		SUBSYSTEM: Hydraulic			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides actuation pressure for all pneumatic actuated valves in proper sequence contained in the Hydraulic subsystem.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Intertank and Aft Skirt		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)	MTBR 6,720 Hrs.	
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition - Monitoring
	X	X			X	X	
OFI REQUIREMENTS: Continuous current signature monitoring for each actuation during flight operation.							
MAINTENANCE FUNCTIONS: Same as item 15							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA									
ITEM IDENTIFICATION:					TABLE 5-1 REF:		FUNCTION NO.		
High Pressure Relief Valve					Item 53		2.10, 2.11, 3.1 & 4.43		
SYSTEM:			SUBSYSTEM:			CRITICALITY:			
Propulsion			Hydraulic			4			
FUNCTIONAL DESCRIPTION: Provides high pressure relief in the event the hydraulic system pressure exceeds the safe upper limit.									
PHYSICAL DESCRIPTION: TBS									
TUG LOCATION:			ACCESSIBILITY			LRU			
Intertank			Adequate			Yes			
LIFE DATA									
OPERATION LIFE:				SHELF LIFE:		MTBF		MTBR	
3,400 Hrs.      TIME      20      CYCLES				Indefinite		4,000 Hrs. (Design Goal)		6,720 Hrs.	
NO. TIMES REFURBISHABLE			ANTICIPATED REFURB/100 FLIGHTS			SPARES REQUIRED:			
18			2.5			TBD			
MAINTENANCE DATA									
MAINTENANCE LEVEL		I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE	
		X	X			X	X	Condition - Monitoring	
OFI REQUIREMENTS:									
Pressure transducer and proximity pickup for valve position indications.									
MAINTENANCE FUNCTIONS:									
1. SCHEDULED MAINTENANCE (LEVEL I)									
a. Review flight OFI for indications of improper valve operation or performance degradation.									
b. Verify relief valve set point and operation.									
2. UNSCHEDULED MAINTENANCE (LEVEL I)									
a. Remove and replace relief valve if OFI indicates failure or performance degradation, verify valve set point and operation.									
3. UNSCHEDULED MAINTENANCE (LEVEL II)									
a. Repair failed valve as applicable, test and return to storage.									
OTHER CONSIDERATIONS/REMARKS									
None									

# TUG MAINTENANCE REQUIREMENTS DATA SHEET

<b>MAINTENANCE ITEM DATA</b>							
ITEM IDENTIFICATION:  Low Pressure Relief Valve				TABLE 5-1 REF:  Item 54		FUNCTION NO. 2.10, 2.11, 3.1 & 4.43	
SYSTEM:  Propulsion		SUBSYSTEM:  Hydraulic			CRITICALITY:  4		
FUNCTIONAL DESCRIPTION: Provides overboard relief of hydraulic fluid when reservoir volume is exceeded.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Intertank and Aft Skirt		ACCESSIBILITY Adequate			LRU Yes		
<b>LIFE DATA</b>							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES			SHELF LIFE: Indefinite	MTBF 4,000 Hours (Design Goal)	MTBR 6,720 Hrs.		
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: TBD		
<b>MAINTENANCE DATA</b>							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE  Condition - Monitoring
	X	X			X	X	
OFI REQUIREMENTS: Same as item 53							
MAINTENANCE FUNCTIONS: Same as item 53							
OTHER CONSIDERATIONS/REMARKS  None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA									
ITEM IDENTIFICATION:					TABLE 5-1 REF:		FUNCTION NO.		
Hydraulic Bleed Valve					Item 55		2.7 & 3.1		
SYSTEM:			SUBSYSTEM:			CRITICALITY:			
Propulsion			Hydraulic			4			
FUNCTIONAL DESCRIPTION: Provides ground operations hydraulic system bleed and sample capability.									
PHYSICAL DESCRIPTION:									
TBS									
TUG LOCATION:			ACCESSIBILITY			LRU			
Intertank			Adequate			Yes			
LIFE DATA									
OPERATION LIFE:				SHELF LIFE:		MTBF		MTBR	
3,400 Hrs. TIME 20 CYCLES				Indefinite		4,000 Hrs. (Design Goal)		6,720 Hrs.	
NO. TIMES REFURBISHABLE			ANTICIPATED REFURB/100 FLIGHTS			SPARES REQUIRED:			
18			1.0			TBD			
MAINTENANCE DATA									
MAINTENANCE LEVEL		I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE	
		X	X			X	X		
On - Condition									
OFI REQUIREMENTS:									
Not Required this valve is used for ground operations only.									
MAINTENANCE FUNCTIONS:									
1. SCHEDULED MAINTENANCE (LEVEL I) a. Visual inspection for evidence of valve leakage and proper operation of manual control. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. Remove and replace defective valve and verify acceptable leakage level. 3. UNSCHEDULED MAINTENANCE (LEVEL II) a. Repair valve as applicable and verify acceptable seat leakage, return to storage.									
OTHER CONSIDERATIONS/REMARKS									
This valve may be inexpensive and will not justify repair									

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA						
ITEM IDENTIFICATION: Hydraulic Filter Assembly				TABLE 5-1 REF: Item 56		FUNCTION NO. 2.10 & 3.1
SYSTEM: Propulsion		SUBSYSTEM: Hydraulic		CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides filtering on the output of the hydraulic pumps to prevent introduction of contaminants into the actuator assembly.						
PHYSICAL DESCRIPTION: TBS						
TUG LOCATION: Intertank and Aft Skirt		ACCESSIBILITY Adequate			LRU Yes	
LIFE DATA						
OPERATION LIFE: 1,320 Hrs. TIME 5 CYCLES			SHELF LIFE: Indefinite		MTBF 1,320 Hrs.	
					MTBR After 5 Flights	
NO. TIMES REFURBISHABLE 3		ANTICIPATED REFURB/100 FLIGHTS 20			SPARES REQUIRED: T3D	
MAINTENANCE DATA						
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD
	X				X	X
OFI REQUIREMENTS: None						
MAINTENANCE FUNCTIONS:  1. SCHEDULED MAINTENANCE (LEVEL I) a. After every 5th flight remove and replace the filter assembly. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. Any time the hydraulic system is opened for purposes of maintenance, remove and replace the filters after system flush.						
OTHER CONSIDERATIONS/REMARKS  None						

# TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Hydraulic Plumbing				TABLE 5-1 REF: Item 57		FUNCTION NO. 2.7, 2.10 & 3.1	
SYSTEM: Propulsion		SUBSYSTEM: Hydraulic			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides all the hydraulic fluid lines in support of the TVC system.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Intertank and Aft Skirt		ACCESSIBILITY Adequate			LRU No		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs.      20      CYCLES				SHELF LIFE: N/A		MTBF N/A	
MTBR N/A							
NO. TIMES REFURBISHABLE N/A		ANTICIPATED REFURB/100 FLIGHTS 1.0			SPARES REQUIRED: No		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On - Condition
	X				X	X	
OFI REQUIREMENTS: None							
MAINTENANCE FUNCTIONS: Same as item 33							
OTHER CONSIDERATIONS/REMARKS None							



## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION:				TABLE 5-1 REF:		FUNCTION NO.	
LO <sub>2</sub> and LH <sub>2</sub> Capacitive Mass Probe				Items 59 & 60		2.10, 2.11 & 3.1	
SYSTEM:		SUBSYSTEM:			CRITICALITY:		
Propulsion		Propellant Load & Measuring			3		
FUNCTIONAL DESCRIPTION: Provides measurement data of the amount of LO <sub>2</sub> and LH <sub>2</sub> in the propellant tanks during loading and main engine firing.							
PHYSICAL DESCRIPTION:							
TBS							
TUG LOCATION:		ACCESSIBILITY			LRU		
LO <sub>2</sub> & LH <sub>2</sub> Tanks		Inadequate LO <sub>2</sub> Tank			Yes		
LIFE DATA							
OPERATION LIFE:			SHELF LIFE:		MTBF		MTBR
3,400 Hrs. TIME 20 CYCLES			Indefinite		4,000 Hrs. (Design Goal)		6,720 Hrs.
NO. TIMES REFURBISHABLE		ANTICIPATED REFURB/100 FLIGHTS			SPARES REQUIRED:		
18		2.5			TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	X		X		X	X	
OFI REQUIREMENTS:							
Baseline identified OFI is adequate							
MAINTENANCE FUNCTIONS:							
1. SCHEDULED MAINTENANCE (LEVEL I) <ul style="list-style-type: none"> <li>a. Review flight OFI data for evidence of failure or performance degradation.</li> <li>b. Verify probe calibration.</li> </ul> 2. UNSCHEDULED MAINTENANCE (LEVEL I) <ul style="list-style-type: none"> <li>a. Remove and replace mass probe and perform system calibration.</li> </ul> 3. UNSCHEDULED MAINTENANCE (LEVEL III) <ul style="list-style-type: none"> <li>a. Return mass probe to vendor for repair and calibration, then return to storage.</li> </ul>							
OTHER CONSIDERATIONS/REMARKS							
None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA								
ITEM IDENTIFICATION:				TABLE 5-1 REF:		FUNCTION NO.		
LO <sub>2</sub> and LH <sub>2</sub> Control Assemblies				Items 61 & 62		2.10, 2.11, 3.1 & 4.21		
SYSTEM:		SUBSYSTEM:			CRITICALITY:			
Propulsion		Propellant Load & Measuring			4			
FUNCTIONAL DESCRIPTION: Provides electronic control of loading activities and in-flight measurements of the LO <sub>2</sub> and LH <sub>2</sub> capacity an in operation calibrations.								
PHYSICAL DESCRIPTION:								
TBS								
TUG LOCATION:		ACCESSIBILITY			LRU			
Intertank		Adequate			Yes			
LIFE DATA								
OPERATION LIFE:			SHELF LIFE:		MTBF	MTBR		
3,400 Hrs. TIME 20 CYCLES			Indefinite		4,000 Hrs. (Design Goal)	6,720 Hrs.		
NO. TIMES REFURBISHABLE		ANTICIPATED REFURB/100 FLIGHTS			SPARES REQUIRED:			
18		2.5			TBD			
MAINTENANCE DATA								
MAINTENANCE LEVEL		I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
		X	X			X	X	
OFI REQUIREMENTS:								
Same as item 59								
MAINTENANCE FUNCTIONS:								
1. SCHEDULED MAINTENANCE (LEVEL I) a. Review Flight OFI data for evidence of failure or performance degradation. b. Perform system calibration. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. Remove and replace failed assembly and perform system calibration. 3. UNSCHEDULED MAINTENANCE (LEVEL II) a. Repair failed assembly as applicable, perform functional test and system calibration. Return to storage.								
OTHER CONSIDERATIONS/REMARKS								
None								

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Power Supply				TABLE 5.1 REF: Item 63		FUNCTION NO. 2.10, 2.11, 3.1 & 4.21	
SYSTEM: Propulsion		SUBSYSTEM: Propellant Load & Measuring			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides operating power for the control assemblies.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Intertank		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)	MTBR 6,720 Hrs.	
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition - Monitoring
	X	X			X	X	
OFI REQUIREMENTS: Same as item 59							
MAINTENANCE FUNCTIONS: Same as item 61							
OTHER CONSIDERATIONS REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Point Level Sensor				TABLE 5-1 REF: Item 64		FUNCTION NO. 2.10, 2.11, 3.1 & 4.21	
SYSTEM: Propulsion		SUBSYSTEM: Propellant Load & Measuring			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provide liquid level sensing within the LO <sub>2</sub> and LH <sub>2</sub> propellant tanks to provide control assemblies with logic signals for loading rate changes and cutoff.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: LO <sub>2</sub> and LH <sub>2</sub> Tanks		ACCESSIBILITY Inadequate LO <sub>2</sub> Tank			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goals)		MTBR 6,720 Hrs.
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition - Monitoring
	X				X	X	
OFI REQUIREMENTS: N/A							
MAINTENANCE FUNCTIONS:  Same as item 61 with the exception that this item is non-reparable							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: APS Motor Assembly				TABLE 5-1 REF: Item 67		FUNCTION NO. 2.10, 2.11, 3.1 & 4.42	
SYSTEM: Propulsion		SUBSYSTEM: APS			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides maneuvering thrust during periods when main engine is not firing, also provides roll vector thrust during main engine firings.							
PHYSICAL DESCRIPTION: Motor assembly occupy's an envelope of 30 x 30 x TBD inches and has a weight of 50 pounds.							
TUG LOCATION: Intertank		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES				SHELF LIFE: Indefinite		MTBF TBD	
						MTBR TBD	
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS TBD			SPARES REQUIRED: TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	X	X			X	X	
OFI REQUIREMENTS: Baseline defined OFI is adequate with the addition of continuous current signature monitoring of solenoid valves.							
MAINTENANCE FUNCTIONS: 1. SCHEDULED MAINTENANCE (LEVEL I) a. Review flight OFI data to determine performance capability of the APS assembly. b. Perform system functional test. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. Remove and replace APS motor assembly if OFI flight data indicates failure or performance degradation. b. Perform system performance test. 3. UNSCHEDULED MAINTENANCE (LEVEL II) a. Repair failed APS assembly as applicable, test, return to storage.							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Solenoid Fuel Prevalve				TABLE 5-1 REF: Item 69		FUNCTION NO. 2.10, 2.11, 3.1 & 4.41	
SYSTEM: Propulsion		SUBSYSTEM: APS			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides control of $N_2H_4$ supply to the APS motor assemblies.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Intertank		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES				SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)	
						MTBR 6,720 Hrs.	
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition - Monitoring
	X	X			X	X	
OFI REQUIREMENTS: Same as item 15							
MAINTENANCE FUNCTIONS: Same as item 15							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: N <sub>2</sub> H <sub>4</sub> Filter Assembly				TABLE 5-1 REF: Item 70		FUNCTION NO. 2.10, 2.11, 3.2 & 4.41	
SYSTEM: Propulsion		SUBSYSTEM: APS			CRITICALITY: 3		
FUNCTIONAL DESCRIPTION: Provides filtering on the output of the N <sub>2</sub> H <sub>4</sub> propellant tanks to prevent introduction of contaminants into the APS fuel lines.							
PHYSICAL DESCRIPTION:  TBS							
TUG LOCATION: Intertank		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 1,320 Hrs. TIME 5 CYCLES				SHELF LIFE: Indefinite		MTBF 1,320 Hrs.	
						MTBR 1,320 Hrs.	
NO. TIMES REFURBISHABLE 3		ANTICIPATED REFURB/100 FLIGHTS 20			SPARES REQUIRED: TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE  Time
	X				X	X	
OFI REQUIREMENTS: None							
MAINTENANCE FUNCTIONS: 1. SCHEDULED MAINTENANCE (LEVEL I) a. Remove and replace the filter assembly after every 5th flight. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. Any time the APS fuel system is opened for maintenance purposes, remove and replace the filters after system flush is completed.							
OTHER CONSIDERATIONS/REMARKS  None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION:  N <sub>2</sub> H <sub>4</sub> Fill and Vent Quick Disconnects				TABLE 5-1 REF:  Items 72 & 73		FUNCTION NO. 2.10, 2.11, 3.1 & 4.41	
SYSTEM:  Propulsion		SUBSYSTEM:  APS			CRITICALITY:  4		
FUNCTIONAL DESCRIPTION: Provides ground operations connections for the purpose of loading and flushing the N <sub>2</sub> H <sub>4</sub> propellants.							
PHYSICAL DESCRIPTION:  TBS							
TUG LOCATION:  Intertank		ACCESSIBILITY  Adequate			LRU  Yes		
LIFE DATA							
OPERATION LIFE:  3,400 Hrs. TIME 20 CYCLES			SHELF LIFE:  Indefinite	MTBF 4,000 Hrs. (Design Goal)	MTBR  6,720 Hrs.		
NO. TIMES REFURBISHABLE  18		ANTICIPATED REFURB/100 FLIGHTS  2.5			SPARES REQUIRED:  TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE  On - Condition
	X				X	X	
OFI REQUIREMENTS:  None							
MAINTENANCE FUNCTIONS:  Same as item 21							
OTHER CONSIDERATIONS/REMARKS  None							



## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: $N_2H_4$ Propellant Tank				TABLE 5-1 REF: Item 74		FUNCTION NO. 2.10, 2.11, 3.1 & 4.41	
SYSTEM: Propulsion		SUBSYSTEM: APS		CRITICALITY: 4			
FUNCTIONAL DESCRIPTION: Provides storage capability for $N_2H_4$ required for the mission.							
PHYSICAL DESCRIPTION: Approximately 32 " diameter sphere.							
TUG LOCATION: Intertank		ACCESSIBILITY Inadequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 1,320 Hrs. TIME 5 CYCLES			SHELF LIFE: Indefinite		MTBF 1,320 Hrs.		
MTBR 5 Flights							
NO. TIMES REFURBISHABLE 3		ANTICIPATED REFURB/100 FLIGHTS 20			SPARES REQUIRED: TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE  Time
	X	X			X	X	
OFI REQUIREMENTS: Baseline defined OFI is adequate.							
MAINTENANCE FUNCTIONS: 1. SCHEDULED MAINTENANCE (LEVEL I) a. Remove and replace the APS propellant tanks after every 5th flight. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. Remove and replace the APS propellant tank any time the OFI data indicates degradation of the elastomer diaphragm is degrading. 3. SCHEDULED MAINTENANCE (LEVEL II) a. Replace the elastomer diaphragm, clean tank, leak test and return to storage.							
OTHER CONSIDERATIONS/REMARKS  None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Electrical Heater				TABLE 5-1 REF: Item 83		FUNCTION NO. 2.10, 2.11, 3.1 & 4.39	
SYSTEM: Thermal Control		SUBSYSTEM: Active Thermal Control			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides temperature conditioning for the forward skirt panel mounted avionics.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Forward Skirt		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 hrs TIME 20 CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 Hrs (Design Goal)		MTBR N/A
NO. TIMES REFURBISHABLE N/A		ANTICIPATED REFURB/100 FLIGHTS N/A			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition-Monitoring
	x				x	x	
OFI REQUIREMENTS: Current signature monitoring during flight operation correlated to forward compartment temperature monitoring. (Heaters are controlled by the central computer.)							
MAINTENANCE FUNCTIONS: 1. Scheduled maintenance (Level I) a. Review OFI data for evidence of malfunction or degraded operation. 2. Unscheduled maintenance (Level I) a. Remove and replace heater based on flight data evidence of malfunction or degradation. b. Scrap non-repairable heater or return to vendor/depot for failure analysis.							
OTHER CONSIDERATIONS/REMARKS  None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION:				TABLE 5-1 REF:		FUNCTION NO.	
Freon Accumulator				Item 84		2.1, 2.10, 2.11 & 3.1	
SYSTEM:		SUBSYSTEM:		CRITICALITY:			
Thermal Control		Active Thermal Control		3			
FUNCTIONAL DESCRIPTION: Maintains positive system pressure at the pumps, compensates for liquid expansion and contraction, and provides makeup for system leakage.							
PHYSICAL DESCRIPTION:							
TBS							
TUG LOCATION:		ACCESSIBILITY			LRU		
Intertank		Adequate			Yes		
LIFE DATA							
OPERATION LIFE:			SHELF LIFE:		MTBF	MTBR	
Indefinite TIME 50 CYCLES			Indefinite		8,500 hrs (Design goal)	10,000 hrs	
NO. TIMES REFURBISHABLE		ANTICIPATED REFURB/100 FLIGHTS			SPARES REQUIRED:		
4		2			1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	x		x		x	x	
OFI REQUIREMENTS:							
Monitor dc output of pressure transducer and monitor for decay at press/vent system supply source..							
MAINTENANCE FUNCTIONS:							
<ol style="list-style-type: none"> <li>1. Scheduled maintenance (Level I) <ol style="list-style-type: none"> <li>a. Review OFI data for evidence of failure or performance degradation.</li> </ol> </li> <li>2. Unscheduled maintenance (Level I) <ol style="list-style-type: none"> <li>a. Remove and replace</li> <li>b. Recharge new accumulator as required during ground system check.</li> <li>c. Return removed accumulator to vendor/depot for repair</li> </ol> </li> </ol>							
OTHER CONSIDERATIONS/REMARKS							
<ol style="list-style-type: none"> <li>3. Unscheduled maintenance (Level III) <ol style="list-style-type: none"> <li>a. Vendor/depot repair and return to site</li> </ol> </li> </ol> <p>None</p>							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Freon Fill Valve				TABLE 5-1 REF: Item 85		FUNCTION NO. 2.1, 2.10 & 3.1	
SYSTEM: Thermal Control		SUBSYSTEM: Active Thermal Control			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides for initial and replenishment charging of freon accumulator							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Intertank		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: Indefinite TIME 50 CYCLES				SHELF LIFE: Indefinite		MTBF 8,500 hrs (Design goal)	
						MTBR 10,000 hrs	
NO. TIMES REFURBISHABLE 5		ANTICIPATED REFURB/100 FLIGHTS 2			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On-Condition
	x		x		x	x	
OFI REQUIREMENTS: N/A							
MAINTENANCE FUNCTIONS: 1. Scheduled maintenance (Level I) a. Check for pressure decay at accumulator during ground operations checkout. 2. Unscheduled maintenance (Level I) a. Remove and replace b. Leak check replaced valve c. Return to vendor/depot for repair 3. Unscheduled maintenance (Level III) a. Vendor/depot repair and return to site							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION:				TABLE 5-1 REF:		FUNCTION NO.	
Freon Pump				Item 86		2.10, 2.11 & 3.1	
SYSTEM:		SUBSYSTEM:		CRITICALITY:			
Thermal Control		Active Thermal Control		4			
FUNCTIONAL DESCRIPTION:							
Provides system circulation of freon 21							
PHYSICAL DESCRIPTION:							
TBS							
TUG LOCATION:		ACCESSIBILITY			LRU		
Intertank		Adequate			Yes		
LIFE DATA							
OPERATION LIFE:			SHELF LIFE:		MTBF	MTBR	
1 year TIME 50 CYCLES			Indefinite		8,500 hrs (design goal)	10,000 hrs	
NO. TIMES REFURBISHABLE		ANTICIPATED REFURB/100 FLIGHTS			SPARES REQUIRED:		
5		2			1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	x		x		x	x	
OFI REQUIREMENTS:							
Monitor pump inlet/outlet pressure and freon flow rates.							
MAINTENANCE FUNCTIONS:							
<ol style="list-style-type: none"> <li>1. Scheduled maintenance (Level I) <ol style="list-style-type: none"> <li>a. Review OFI data for evidence of failure or performance degradation.</li> </ol> </li> <li>2. Unscheduled maintenance (Level II) <ol style="list-style-type: none"> <li>a. Remove and replace</li> <li>b. System check replaced pump during ground operations</li> <li>c. Return removed pump to vendor/depot for repair</li> </ol> </li> <li>3. Unscheduled maintenance (Level III)</li> </ol>							
OTHER CONSIDERATIONS/REMARKS							
<ol style="list-style-type: none"> <li>a. Vendor/depot repair and return to site.</li> </ol> <p>None</p>							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION:				TABLE 5-1 REF:		FUNCTION NO.	
Dryer Assembly				Item 87		2.1, 2.10 & 3.1	
SYSTEM:		SUBSYSTEM:		CRITICALITY:			
Thermal Control		Active Thermal Control		4			
FUNCTIONAL DESCRIPTION:							
Removes moisture from Freon 21							
PHYSICAL DESCRIPTION:							
TBS							
TUG LOCATION:		ACCESSIBILITY			LRU		
Intertank		Adequate			Yes		
LIFE DATA							
OPERATION LIFE:			SHELF LIFE:		MTBF	MTBR	
Indefinite TIME N/A CYCLES			Indefinite		TBD	TBD	
NO. TIMES REFURBISHABLE		ANTICIPATED REFURB/100 FLIGHTS			SPARES REQUIRED:		
TBD		TBD			1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	x				x	x	
OFI REQUIREMENTS:							
N/A							
MAINTENANCE FUNCTIONS:							
1. Scheduled maintenance (Level I) a. Monitor discharge temperature during ground operational check for evidence of dryer degradation. 2. Unscheduled maintenance (Level I) a. Remove and replace.							
OTHER CONSIDERATIONS/REMARKS							
None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Filter				TABLE 5-1 REF: Item 88		FUNCTION NO. 2.1, 2.10 & 3.1	
SYSTEM: Thermal Control		SUBSYSTEM: Active Thermal Control			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Protects temperature mixing valves from contamination							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Intertank		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: Indefinite TIME N/A CYCLES			SHELF LIFE: Indefinite		MTBF TBD	MTBR N/A	
NO. TIMES REFURBISHABLE N/A		ANTICIPATED REFURB/100 FLIGHTS N/A			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition-monitoring
	x				x	x	
OFI REQUIREMENTS: Monitor $\Delta P$ across filter							
MAINTENANCE FUNCTIONS: 1. Scheduled maintenance (Level I) a. Review OFI differential pressure data for evidence of filter clogging. 2. Unscheduled maintenance (Level I) a. Remove and replace filter							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Filter Bypass Valve				TABLE 5-1 REF: Item 89		FUNCTION NO. 2.1.2.10 & 3.1	
SYSTEM: Thermal Control		SUBSYSTEM: Active Thermal Control			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides filter bypass in case of filter clogging							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Intertank		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: N/A      TIME    20      CYCLES				SHELF LIFE: Indefinite		MTBF 8,500 hrs (design goal)	
						MTBR 10,000 hrs	
NO. TIMES REFURBISHABLE 4		ANTICIPATED REFURB/100 FLIGHTS 2			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On-Condition
	x	x			x	x	
OFI REQUIREMENTS: N/A							
MAINTENANCE FUNCTIONS: 1. Scheduled maintenance (Level I) a. Remove valve and ground check after 20 flights b. Replace removed valve 2. Unscheduled maintenance (Level II) a. Repair as required and return to spare inventory							
OTHER CONSIDERATIONS/REMARKS None							



## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Heat Exchanger - Pre Flight				TABLE 5-1 REF: Item 90		FUNCTION NO. 2.10 & 3.1	
SYSTEM: Thermal Control		SUBSYSTEM: Active Thermal Control			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides ground cooling during fuel cell checkout							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Intertank		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: Indefinite TIME N/A CYCLES			SHELF LIFE: Indefinite		MTBF N/A		MTBR N/A
NO. TIMES REFURBISHABLE N/A		ANTICIPATED REFURB/100 FLIGHTS N/A			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On-Condition
	x				x	x	
OFI REQUIREMENTS: N/A - ground operation only							
MAINTENANCE FUNCTIONS: 1. Scheduled maintenance (Level I) a. Monitor output temperature during ground operations for indication of failure or degraded operation. 2. Unscheduled maintenance (Level I) a. Remove and replace							
OTHER CONSIDERATIONS/REMARKS  None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION:				TABLE 5-1 REF:		FUNCTION NO.	
Radiator				Item 91		2.10 & 3.1	
SYSTEM:		SUBSYSTEM:			CRITICALITY:		
Thermal Control		Active Thermal Control			3		
FUNCTIONAL DESCRIPTION:							
Provides for heat transfer							
PHYSICAL DESCRIPTION:							
24" x 48" x TBS, weight = TBS							
TUG LOCATION:			ACCESSIBILITY			LRU	
Intertank			Adequate			Yes	
LIFE DATA							
OPERATION LIFE:				SHELF LIFE:		MTBF	MTBR
Indefinite TIME 50 CYCLES				Indefinite		8,500 hrs (Design goal)	10,000 hrs
NO. TIMES REFURBISHABLE			ANTICIPATED REFURB/100 FLIGHTS			SPARES REQUIRED:	
5			2			1 Ship Set	
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	x	x			x	x	
OFI REQUIREMENTS:							
N/A							
MAINTENANCE FUNCTIONS:							
<ol style="list-style-type: none"> <li>1. Scheduled maintenance (Level I) <ol style="list-style-type: none"> <li>a. Visually inspect for physical damage</li> </ol> </li> <li>2. Unscheduled maintenance (Level I) <ol style="list-style-type: none"> <li>a. Remove and replace</li> </ol> </li> <li>3. Unscheduled maintenance (Level II) <ol style="list-style-type: none"> <li>a. Repair on site</li> </ol> </li> </ol>							
OTHER CONSIDERATIONS/REMARKS							
None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Selector Valve				TABLE 5-1 REF: Item 92		FUNCTION NO. 2.10, 2.11 & 3.1	
SYSTEM: Thermal Control		SUBSYSTEM: Active Thermal Control			CRITICALITY: 3		
FUNCTIONAL DESCRIPTION: Provide coolant flow to the desired temperature mixing valve							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Intertank		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: N/A TIME 50 CYCLES				SHELF LIFE: Indefinite		MTBF 8,500 hrs (Design goal)	
						MTBR 10,000 hrs	
NO. TIMES REFURBISHABLE 5		ANTICIPATED REFURB: 100 FLIGHTS 2			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition-monitoring
	x	x			x	x	
OFI REQUIREMENTS: Monitor valve position.							
MAINTENANCE FUNCTIONS: 1. Scheduled maintenance (Level I) a. Review OFI data for evidence of failure or performance degradation. 2. Unscheduled maintenance (Level I) a. Remove and replace 3. Unschedule maintenance (Level II) a. Repair on site							
OTHER CONSIDERATIONS: REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION:				TABLE 5-1 REF:		FUNCTION NO.	
Flow Control Valve				Item 93		2.10, 2.11 & 3.1	
SYSTEM:		SUBSYSTEM:			CRITICALITY:		
Thermal Control		Active Thermal Control			4		
FUNCTIONAL DESCRIPTION:							
Regulates amount of coolant flowing through or bypassing the radiator.							
PHYSICAL DESCRIPTION:							
TBS							
TUG LOCATION:		ACCESSIBILITY			LRU		
Intertank		Adequate			Yes		
LIFE DATA							
OPERATION LIFE:			SHELF LIFE:		MTBF	MTBR	
N/A TIME 50 CYCLES			Indefinite		8,500 hrs (Design Goal)	10,000 hrs	
NO. TIMES REFURBISHABLE		ANTICIPATED REFURB/100 FLIGHTS			SPARES REQUIRED:		
5		2			1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	x	x			x	x	
OFI REQUIREMENTS:							
Monitor Valve Position							
MAINTENANCE FUNCTIONS:							
Same as item 92							
OTHER CONSIDERATIONS/REMARKS							
None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Temperature Sensor				TABLE 5-1 REF: Item 94		FUNCTION NO. 2.10, 2.11, 3.1 & 4.21	
SYSTEM: Thermal Control		SUBSYSTEM: Active Thermal Control		CRITICALITY: 3			
FUNCTIONAL DESCRIPTION: Measures temperature of coolant entering fuel cell heat exchanger.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: I certank		ACCESSIBILITY Adequate		LRU Yes			
LIFE DATA							
OPERATION LIFE: 3,400 hrs TIME 20 CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 hrs (design goal)	MTBR 6,720 Hrs	
NO. TIMES REFURBISHABLE N/A		ANTICIPATED REFURB/100 FLIGHTS N/A		SPARES REQUIRED: 1 Ship Set			
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition-monitoring
	x				x	x	
OFI REQUIREMENTS: Monitor output of temperature sensor							
MAINTENANCE FUNCTIONS: 1. Scheduled maintenance (Level I) a. Review OFI data for evidence of failure or performance degradation. 2. Unscheduled maintenance (Level I) a. Remove and replace							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Helium Control Valve				TABLE 5-1 REF: Item 95		FUNCTION NO. 2.1, 2.10, 2.11 & 3.1	
SYSTEM: Thermal Control		SUBSYSTEM: Active Thermal Control			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides shutoff control for helium supply to the freon accumulator							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Intertank		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: N/A      TIME 50      CYCLES				SHELF LIFE: Indefinite		MTBF 8,500 hrs (Design goal)	
						MTBR 10,000 hrs	
NO. TIMES REFURBISHABLE 5		ANTICIPATED REFURB/100 FLIGHTS 2			SPARES REQUIRED: 1 ship set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition-Monitoring
	x	x			x	x	
OFI REQUIREMENTS: Monitor valve position							
MAINTENANCE FUNCTIONS:  Same as item 92							
OTHER CONSIDERATIONS/REMARKS  None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Helium Regulator Valve				TABLE 5-1 REF: Item 96		FUNCTION NO. 2.1, 2.10, 2.11 & 3.1	
SYSTEM: Thermal Control		SUBSYSTEM: Active Thermal Control			CRITICALITY: TBD		
FUNCTIONAL DESCRIPTION: Regulates the pressure of helium entering the freon accumulator from the pressurization and vent system							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Intertank		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 hrs TIME 20 CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 hrs (Design Goal)		MTBR 6,720 hrs
NO. TIMES REFURBISHABLE 5		ANTICIPATED REFURB/100 FLIGHTS 3			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition-monitoring
	x	x			x	x	
OPI REQUIREMENTS: Monitor valve operation							
MAINTENANCE FUNCTIONS: Same as item 92							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Helium Vent Valve				TABLE 5.1 REF: Item 97		FUNCTION NO. 2.1, 2.10, 2.11 & 3.1	
SYSTEM: Thermal Control		SUBSYSTEM: Active Thermal Control			CRITICALITY: TBD		
FUNCTIONAL DESCRIPTION: Provide relief for excessive helium pressure in the freon accumulator due to thermal expansion of coolant or regulator malfunction.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Intertank		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 hrs TIME 20 CYCLES				SHELF LIFE: Indefinite		MTBF 4,000 hrs (Design Goal)	
						MTBR 6,720 hrs	
NO. TIMES REFURBISHABLE 5		ANTICIPATED REFURB/100 FLIGHTS 3			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On-Condition
	x	x			x	x	
OFI REQUIREMENTS: N/A							
MAINTENANCE FUNCTIONS: 1. Scheduled maintenance (Level I) a. Ground check for proper operation and relief setting after 20 flights. 2. Unscheduled maintenance (Level I) a. Remove and replace as required 3. Unscheduled maintenance (Level II) a. Repair onsite and adjust to relief setting							
OTHER CONSIDERATIONS/REMARKS None							



## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION:				TABLE 5-1 REF:		FUNCTION NO.	
Heat Pipe				Item 98		2.10 & 3.1	
SYSTEM:		SUBSYSTEM:			CRITICALITY:		
Thermal Control		Active Thermal Control			TBD		
FUNCTIONAL DESCRIPTION:							
Transfer heat from hot side to cool side of the vehicle for thermal control of circumferential gradient							
PHYSICAL DESCRIPTION:							
$\frac{1}{2}$ " x $\frac{1}{2}$ " x 120", weight = TBD							
TUG LOCATION:		ACCESSIBILITY			LRU		
Intertank/Fwd Skirt		Adequate			Yes		
LIFE DATA							
OPERATION LIFE:				SHELF LIFE:		MTBF	
Indefinite TIME N/A CYCLES				Indefinite		TBD	
NO. TIMES REFURBISHABLE				ANTICIPATED REFURB/100 FLIGHTS		SPARES REQUIRED:	
N/A				N/A		1 Ship Set	
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	x				x	x	
OFI REQUIREMENTS:							
N/A							
MAINTENANCE FUNCTIONS:							
1. Scheduled maintenance (Level I) <ul style="list-style-type: none"> <li>a. Visually inspect for damage</li> </ul> 2. Unscheduled maintenance (Level I) <ul style="list-style-type: none"> <li>a. Remove and replace</li> </ul>							
OTHER CONSIDERATIONS/REMARKS							
None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA								
ITEM IDENTIFICATION: Thermal Splice				TABLE 5-1 REF: Item 99		FUNCTION NO. 2.10 & 3.1		
SYSTEM: Thermal Control		SUBSYSTEM: Active Thermal Control			CRITICALITY: 4			
FUNCTIONAL DESCRIPTION: Provides thermal connection between lengths of heat pipe								
PHYSICAL DESCRIPTION: TBS								
TUG LOCATION: Intertank/Fwd Skirt		ACCESSIBILITY Adequate			LRU Yes			
LIFE DATA								
OPERATION LIFE: Indefinite TIME N/A CYCLES				SHELF LIFE: Indefinite	MTBF TBD		MTBR TBD	
NO. TIMES REFURBISHABLE N/A		ANTICIPATED REFURB/100 FLIGHTS N/A			SPARES REQUIRED: 1 Ship Set			
MAINTENANCE DATA								
MAINTENANCE LEVEL		I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On-condition
		x				x	x	
OFI REQUIREMENTS: N/A								
MAINTENANCE FUNCTIONS: Same as item 98								
OTHER CONSIDERATIONS/REMARKS None								

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Multilayer Insulation - LH <sub>2</sub> Tank				TABLE 5-1 REF: Item 101		FUNCTION NO. 2.7, 3.1 & 4.23	
SYSTEM: Thermal Control		SUBSYSTEM: LH <sub>2</sub> Tank Insultion			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Protects LH <sub>2</sub> tank from propellant heating							
PHYSICAL DESCRIPTION: Goldized Kapton Superfloc, 23 layer, 0.77" thick, weight = 90 lbs							
TUG LOCATION: LH <sub>2</sub> Tank Wrap		ACCESSIBILITY N/A			LRU No		
LIFE DATA							
OPERATION LIFE: N/A      TIME      N/A      CYCLES				SHELF LIFE: N/A		MTBF N/A	
MTBR N/A							
NO. TIMES REFURBISHABLE N/A		ANTICIPATED REFURB/100 FLIGHTS N/A			SPARES REQUIRED: No		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE  On-Condition
	x		x		x	x	
O/FI REQUIREMENTS:  N/A							
MAINTENANCE FUNCTIONS: 1. Scheduled maintenance (Level I) a. Visual inspection for outer layer contamination due to moisture if access provided through purge bag. 2. Unscheduled maintenance (Level III) a. Evidence of mission critical contamination/degradation would require return of Tug to manufacturer or depot for replacement of insulation.							
OTHER CONSIDERATIONS/REMARKS  None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Purge Bag - LH <sub>2</sub> Tank					TABLE 5-1 REF: Item 102		FUNCTION NO. 2.7, 3.1 & 4.23
SYSTEM: Thermal Control			SUBSYSTEM: LH <sub>2</sub> Tank Insulation			CRITICALITY: 4	
FUNCTIONAL DESCRIPTION: Provides housing for insulation, purge containment, and added micrometeoroid shielding.							
PHYSICAL DESCRIPTION: Teflon impregnated Dacron							
TUG LOCATION: LH <sub>2</sub> Tank Wrap			ACCESSIBILITY TBD			LRU No	
LIFE DATA							
OPERATION LIFE: N/A TIME N/A CYCLES				SHELF LIFE: N/A		MTBF N/A	
						MTBR N/A	
NO. TIMES REFURBISHABLE N/A			ANTICIPATED REFURB/100 FLIGHTS N/A			SPARES REQUIRED: No	
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On-Condition
	x				x	x	
OFI REQUIREMENTS: N/A							
MAINTENANCE FUNCTIONS: 1. Scheduled maintenance (Level I) a. Visual inspection for evidence of tears/punctures. 2. Unscheduled maintenance (Level I) a. Perform patch on purge bag							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Multilayer Insulation - LO <sub>2</sub> Tank				TABLE 5-1 REF: Item 104		FUNCTION NO. 2.7, 3.1 & 4.23	
SYSTEM: Thermal Control		SUBSYSTEM: LO <sub>2</sub> Tank Insulation			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Protects LO <sub>2</sub> tank from propellant heating							
PHYSICAL DESCRIPTION: Goldized Kapton Superfloc, 23 layer, 0.77" thick, weight = 40 pounds							
TUG LOCATION: LO <sub>2</sub> Tank Wrap		ACCESSIBILITY N/A			LRU No		
LIFE DATA							
OPERATION LIFE: N/A      TIME   N/A      CYCLES				SHELF LIFE: N/A		MTBF N/A	
						MTBR N/A	
NO. TIMES REFURBISHABLE N/A		ANTICIPATED REFURB/100 FLIGHTS N/A			SPARES REQUIRED: No		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On-condition
	x		x		x	x	
OFI REQUIREMENTS: N/A							
MAINTENANCE FUNCTIONS: Same as item 101							
OTHER CONSIDERATIONS REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA									
ITEM IDENTIFICATION: Purge Bay - LO <sub>2</sub> Tank						TABLE 5-1 REF: Item 105		FUNCTION NO. 2.7, 3.1 & 4.23	
SYSTEM: Thermal Control			SUBSYSTEM: LO <sub>2</sub> Tank Insulation			CRITICALITY: 4			
FUNCTIONAL DESCRIPTION: Provides housing for insulation, purge containment, and added micrometeoroid shielding									
PHYSICAL DESCRIPTION: Teflon impregnated Dacron									
TUG LOCATION: LO <sub>2</sub> Tank Wrap			ACCESSIBILITY TBD			LRU No			
LIFE DATA									
OPERATION LIFE: N/A TIME N/A CYCLES				SHELF LIFE: N/A		MTBF N/A		MTBR N/A	
NO. TIMES REFURBISHABLE N/A			ANTICIPATED REFURB/100 FLIGHTS N/A			SPARES REQUIRED: No			
MAINTENANCE DATA									
MAINTENANCE LEVEL		I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On-Condition	
		x				x	x		
OFI REQUIREMENTS: N/A									
MAINTENANCE FUNCTIONS: 1. Scheduled maintenance (Level I) a. Visual inspection for evidence of tears/punctures 2. Unscheduled maintenance (Level I) a. Perform patch on purge bag									
OTHER CONSIDERATIONS REMARKS  None									

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION:				TABLE 5-1 REF:		FUNCTION NO.	
LH <sub>2</sub> Purge Pressure Regulator				Item 107		2.10, 2.11, 3.1 & , 4.21	
SYSTEM:		SUBSYSTEM:		CRITICALITY:			
Thermal Control		Insulation Purge		4			
FUNCTIONAL DESCRIPTION:							
Regulates He purge pressure to the LH <sub>2</sub> purge bag							
PHYSICAL DESCRIPTION:							
TBS							
TUG LOCATION:		ACCESSIBILITY			LRU		
Adapter		Adequate			Yes		
LIFE DATA							
OPERATION LIFE:			SHELF LIFE:	MTBF	MTBR		
3,400 hrs TIME 20 CYCLES			Indefinite	4,000 hrs (Design goals)	6,720 hrs		
NO. TIMES REFURBISHABLE		ANTICIPATED REFURB/100 FLIGHTS			SPARES REQUIRED:		
5		3			1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	x				x	x	
OFI REQUIREMENTS:							
N/A							
MAINTENANCE FUNCTIONS:							
<ol style="list-style-type: none"> <li>1. Scheduled maintenance (Level I) <ol style="list-style-type: none"> <li>a. Ground checkout of pressure regulator, recalibration every 20 flights</li> </ol> </li> <li>2. Unscheduled maintenance (Level I) <ol style="list-style-type: none"> <li>a. Remove and replace as required</li> </ol> </li> </ol>							
OTHER CONSIDERATIONS REMARKS							
None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LO <sub>2</sub> Purge Pressure Regulator				TABLE 5-1 REF: Item 108		FUNCTION NO. 2.10, 2.11, 3.1 & 4.21	
SYSTEM: Thermal Control		SUBSYSTEM: Insulation Purge			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Regulates He purge pressure to the LO <sub>2</sub> purge bag							
PHYSICAL DESCRIPTION:  TBS							
TUG LOCATION: Adapter		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 hrs TIME 20 CYCLES				SHELF LIFE: Indefinite		MTBF 4,000 hrs (Design goal)	
						MTBR 6,720 hrs	
NO. TIMES REFURBISHABLE 5		ANTICIPATED REFURB/100 FLIGHTS 3			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE  On-Condition
	x				x	x	
OFI REQUIREMENTS:  N/A							
MAINTENANCE FUNCTIONS:  1. Scheduled maintenance (Level I) a. Ground checkout of pressure regulator, recalibration every 20 flights. 2. Unscheduled maintenance (Level I) a. Remove and replace as required.							
OTHER CONSIDERATIONS/REMARKS  None							



## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LH <sub>2</sub> Purge Control Valve				TABLE 5-1 REF: Item 109		FUNCTION NO. 2.10, 2.11, 3.1 & 4.23	
SYSTEM: Thermal Control		SUBSYSTEM: Insulation Purge			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides shutoff control for He purge supply to the LH <sub>2</sub> purge bag.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Adapter		ACCESSIBILITY Adapter			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 hrs TIME 20 CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 hrs (Design goal)	MTBR 6,720 hrs	
NO. TIMES REFURBISHABLE 5		ANTICIPATED REFURB 100 FLIGHTS 3			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On-Condition
	x	x			x	x	
OFI REQUIREMENTS: N/A							
MAINTENANCE FUNCTIONS: <ol style="list-style-type: none"> <li>1. Scheduled maintenance (Level I) <ol style="list-style-type: none"> <li>a. Ground check for proper valve operation</li> </ol> </li> <li>2. Unscheduled maintenance (Level I) <ol style="list-style-type: none"> <li>a. Remove and replace as required</li> </ol> </li> <li>3. Unscheduled maintenance (Level II) <ol style="list-style-type: none"> <li>a. Repair on site and retest</li> </ol> </li> </ol>							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LO <sub>2</sub> Purge Control Valve				TABLE 5-1 REF: Item 110		FUNCTION NO. 2.10, 2.11, 3.1 & 4.23	
SYSTEM: Thermal Control <sup>1</sup>		SUBSYSTEM: Insulation Purge		CRITICALITY: 4			
FUNCTIONAL DESCRIPTION: Provides shutoff control for He purge supply to the LO <sub>2</sub> purge bag.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Adapter		ACCESSIBILITY Adapter			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 hrs TIME 20 CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 hrs (Design Goal)	MTBR 6,720 hrs	
NO. TIMES REFURBISHABLE 5		ANTICIPATED REFURB/100 FLIGHTS 3			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On-Condition
	x	x			x	x	
OFI REQUIREMENTS: N/A							
MAINTENANCE FUNCTIONS: 1. Scheduled maintenance (Level I) a. Ground check for proper valve operation 2. Unscheduled maintenance (Level I) a. Remove and replace as required 3. Unscheduled maintenance (Level II) a. Repair on site and retest							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LH <sub>2</sub> Purge Vent Valve				TABLE 5-1 REF: Item 111		FUNCTION NO. 2.10, 2.11, 3.1 & 4.23	
SYSTEM: Thermal Control		SUBSYSTEM: Insulation Purge			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides vent capability for purge operations							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Intertank		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 hrs TIME 20 CYCLES				SHELF LIFE: Indefinite		MTBF 4,000 hrs (Design Goal)	
						MTBR 6,720 hrs	
NO. TIMES REFURBISHABLE 5		ANTICIPATED REFURB/100 FLIGHTS 3			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On-Condition
	x	x			x	x	
OFI REQUIREMENTS: N/A							
MAINTENANCE FUNCTIONS: 1. Scheduled maintenance (Level I) a. Ground check for proper operation and relief setting after 20 flights 2. Unscheduled maintenance (Level I) a. Remove and replace as required. 3. Unscheduled maintenance (Level II) a. Repair on site and adjust to relief setting							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: LO <sub>2</sub> Purge Vent Valve				TABLE 5-1 REF: Item 112		FUNCTION NO. 2.10, 2.11, 3.1 & 4.23	
SYSTEM: Thermal Control		SUBSYSTEM: Insulation Purge			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides vent capability for purge operations							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Aft Skirt		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 hrs TIME      20 CYCLES				SHELF LIFE: Indefinite		MTBF 4,000 hrs (Design Goal)	
						MTBR 6,720 hrs	
NO. TIMES REFURBISHABLE 5		ANTICIPATED REFURB/100 FLIGHTS 3			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On-Condition
	x	x			x	x	
OFI REQUIREMENTS: N/A							
MAINTENANCE FUNCTIONS: Same as item 111							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Radiation Shield				TABLE 5-1 REF: Item 114		FUNCTION NO. 2.7 & 3.1	
SYSTEM: Thermal Control		SUBSYSTEM: Passive Thermal Control			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides thermal protection during payload orientation towards the sun.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Fwd Skirt - external to panels			ACCESSIBILITY Adequate			LRU Yes	
LIFE DATA							
OPERATION LIFE: Indefinite TIME N/A CYCLES				SHELF LIFE: Indefinite		MTBF N/A	
						MTBR N/A	
NO. TIMES REFURBISHABLE N/A			ANTICIPATED REFURB/100 FLIGHTS N/A			SPARES REQUIRED: 1 Ship Set	
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE On-Condition
	x				x	x	
OFI REQUIREMENTS: N/A							
MAINTENANCE FUNCTIONS: 1. Scheduled maintenance (Level I) a. Visually inspect for damage 2. Unscheduled maintenance (Level I) a. Remove and replace							
OTHER CONSIDERATIONS REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Inertial Measurement Unit				TABLE 5-1 REF: Item 118		FUNCTION NO. 2.10, 2.11, 3.1 & 4.43	
SYSTEM: Avionics		SUBSYSTEM: Navigation, Guidance & Cont.		CRITICALITY: 4			
FUNCTIONAL DESCRIPTION: Provides measurement data on incremental changes in Tug Attitude and Velocity in support of the Navigation and Guidance equations.							
PHYSICAL DESCRIPTION: 16 inch sphere, weighing approximately 42 pounds							
TUG LOCATION: Forward Skirt		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 60,000 Hrs. TIME 20 CYCLES			SHELF LIFE: Indefinite		MTBF 10,000 Hrs.	MTBR 10,000 Hrs.	
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 1.5			SPARES REQUIRED: TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition - Monitoring
	X		X		X	X	
OFI REQUIREMENTS: Baseline self-test capability adequate.							
MAINTENANCE FUNCTIONS:							
1. SCHEDULED MAINTENANCE (LEVEL I) a. Review flight OFI data to determine if a failure or performance degradation has occurred. b. Perform system functional test and calibration. 2. UNSCHEDULED MAINTENANCE (LEVEL I) a. Remove and replace the unit if the OFI or test/calibration data indicates a failure or performance degradation, perform system functional test and calibration. 3. UNSCHEDULED MAINTENANCE (LEVEL III) a. Repair as applicable, test/calibrate and return to storage.							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Rate Gyro				TABLE 5-1 REF: Item 119		FUNCTION NO. 2.10, 2.11, 3.1 & 4.43	
SYSTEM: Avionics		SUBSYSTEM: Navigation, Guidance & Cont.			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides Tug attitude rate information which is a input to the control equation.							
PHYSICAL DESCRIPTION: The rate gyro occupys an envelope of 7 x 6 x 3 inches, weighing approximately 9 pounds.							
TUG LOCATION: Forward Skirt		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)	MTBR 6,720 Hrs.	
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition - Monitoring
	X		X		X	X	
OFI REQUIREMENTS: Same as item 118							
MAINTENANCE FUNCTIONS:  Same as item 118							
OTHER CONSIDERATIONS/REMARKS  None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION:				TABLE 5-1 REF:		FUNCTION NO.	
Accelerometer				Item 120		2.10, 2.11, 3.1 & 4.43	
SYSTEM:		SUBSYSTEM:			CRITICALITY:		
Avionics		Navigation, Guidance & Cont.			4		
FUNCTIONAL DESCRIPTION: Provides Tug acceleration rate information which is a input to the control equation.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION:		ACCESSIBILITY			LRU		
Forward Skirt		Adequate			Yes		
LIFE DATA							
OPERATION LIFE:				SHELF LIFE:		MTBF	
3,400 Hrs. TIME 20 CYCLES				Indefinite		4,000 Hrs. (Design Goal)	
MTBR				6,720 Hrs.			
NO. TIMES REFURBISHABLE		ANTICIPATED REFURB/100 FLIGHTS			SPARES REQUIRED:		
18		2.5			TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	X		X		X	X	
OFI REQUIREMENTS:							
Same as item 118							
MAINTENANCE FUNCTIONS:							
Same as item 118							
OTHER CONSIDERATIONS/REMARKS							
None							



## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Star Tracker				TABLE 5-1 REF: Item 121		FUNCTION NO. 2.10, 2.11, 3.1 & 4.43	
SYSTEM: Avionics		SUBSYSTEM: Navigation, Guidance & Cont.			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides attitude position reference for maneuvers and attitude control reference in the celestial pointing mode.							
PHYSICAL DESCRIPTION: The star tracker occupies an envelope of 5" diameter x 12", weighing approximately 12.5 pounds.							
TUG LOCATION: Forward Skirt		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)		MTBR 6,720 Hrs.
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition - Monitoring
	X		X		X	X	
OFI REQUIREMENTS: Same as item 118							
MAINTENANCE FUNCTIONS: Same as item 118							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION:				TABLE 5-1 REF:		FUNCTION NO.	
Sun Sensor				Item 122		2.10, 2.11, 3.1 & 4.43	
SYSTEM:		SUBSYSTEM:			CRITICALITY:		
Avionics		Navigation, Guidance & Cont.			4		
FUNCTIONAL DESCRIPTION: Provides attitude position reference for maneuvers attitude control reference in the sun pointing mode.							
PHYSICAL DESCRIPTION: The sun sensor occupys an envelope of 6.9 x 6.5 x 3 inches, weighing approximately 4.66 pounds.							
TUG LOCATION:			ACCESSIBILITY			LRU	
Forward Skirt			Adequate			Yes	
LIFE DATA							
OPERATION LIFE:				SHELF LIFE:		MTBF	MTBR
3,400 Hrs. TIME 20 CYCLES				Indefinite		4,000 Hrs. (Design Goal)	6,720 Hrs.
NO. TIMES REFURBISHABLE			ANTICIPATED REFURB/100 FLIGHTS			SPARES REQUIRED:	
18			2.5			TBD	
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	X		X		X	X	
OFI REQUIREMENTS.							
Same as item 118							
MAINTENANCE FUNCTIONS:							
Same as item 118							
OTHER CONSIDERATIONS REMARKS							
None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION:				TABLE 5-1 REF:		FUNCTION NO.	
Electronics Control Unit				Item 123		2.10, 2.11, 3.1 & 4.43	
SYSTEM:		SUBSYSTEM:			CRITICALITY:		
Avionics		Navigation, Guidance & Cont.			4		
FUNCTIONAL DESCRIPTION: Provides the primary control logic and interface between the various elements of the Navigation, Guidance and Control subsystem.							
PHYSICAL DESCRIPTION: The electronics control unit occupies an envelope of 12 x 12 x 18 inches, weighing approximately 50 pounds.							
TUG LOCATION:		ACCESSIBILITY			LRU		
Forward Skirt		Adequate			Yes		
LIFE DATA							
OPERATION LIFE:			SHELF LIFE:		MTBF		MTBR
3,400 Hrs. TIME 20 CYCLES			Indefinite		4,000 Hrs. (Design Goal)		6,720 Hrs.
NO. TIMES REFURBISHABLE		ANTICIPATED REFURB/100 FLIGHTS			SPARES REQUIRED:		
18		2.5			TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	X		X		X	X	
OFI REQUIREMENTS:							
Same as item 118							
MAINTENANCE FUNCTIONS:							
Same as item 118							
OTHER CONSIDERATIONS/REMARKS							
None							

# TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION:				TABLE 5-1 REF:		FUNCTION NO.	
Laser Radar				Item 125		2.10, 2.11, 3.1 & 4.43	
SYSTEM:		SUBSYSTEM:			CRITICALITY:		
Avionics		Rendezvous & Docking			3		
FUNCTIONAL DESCRIPTION: Provides attitude and velocity references for either automatic or remote controlled rendezvous and docking operations.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION:		ACCESSIBILITY			LRU		
Forward Skirt		Adequate			Yes		
LIFE DATA							
OPERATION LIFE:			SHELF LIFE:		MTBF	MTBR	
3,400 Hrs. TIME 20 CYCLES			Indefinite		4,000 Hrs. (Design Goal)	6,720 Hrs.	
NO. TIMES REFURBISHABLE		ANTICIPATED REFURB/100 FLIGHTS			SPARES REQUIRED:		
18		2.5			TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	X		X		X	X	
CFI REQUIREMENTS:							
Same as item 118							
MAINTENANCE FUNCTIONS:							
Same as item 118							
OTHER CONSIDERATIONS/REMARKS							
None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Laser Radar Electronics				TABLE 5-1 REF: Item 126		FUNCTION NO. 2.10, 2.11, 3.1 & 4.43	
SYSTEM: Avionics		SUBSYSTEM: Rendezvous & Docking			CRITICALITY: 3		
FUNCTIONAL DESCRIPTION: Provides the primary control logic and interface between the Laser Radar and the Digital Computer.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Forward Skirt		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES				SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)	
						MTBR 6,720 Hrs.	
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition - Monitoring
	X		X		X	X	
OFI REQUIREMENTS: Same as item 118							
MAINTENANCE FUNCTIONS:  Same as item 118							
OTHER CONSIDERATIONS/REMARKS  None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION:				TABLE 5-1 REF:		FUNCTION NO.	
Digital Computer				Item 128		2.10, 2.11, 3.1 & 4.43	
SYSTEM:		SUBSYSTEM:		CRITICALITY:			
Avionics		Data Management		3			
FUNCTIONAL DESCRIPTION: The Digital Computer provides the primary control over all Tug functions and activities, and in addition provides for self test capability of the various Tug subsystems.							
PHYSICAL DESCRIPTION: The Digital Computer occupies an envelope of 5.4 x 10.5 x 19.8 inches, weighing approximately 65 pounds.							
TUG LOCATION:		ACCESSIBILITY		LRU			
Forward Skirt		Adequate		Yes			
LIFE DATA							
OPERATION LIFE:			SHELF LIFE:	MTBF	MTBR		
3,400 Hrs. TIME 20 CYCLES			Indefinite	4,000 Hrs. (Design Goal)	6,720 Hrs.		
NO. TIMES REFURBISHABLE		ANTICIPATED REFURB/100 FLIGHTS		SPARES REQUIRED:			
18		2.5		TBD			
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	X		X		X	X	
OFI REQUIREMENTS:							
Same as item 118							
MAINTENANCE FUNCTIONS:							
Same as item 118							
OTHER CONSIDERATIONS/REMARKS							
None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Auxiliary Memory				TABLE 5-1 REF: Item 129		FUNCTION NO. 2.10, 2.11, 3.1 & 4.43	
SYSTEM: Avionics		SUBSYSTEM: Data Management		CRITICALITY: 4			
FUNCTIONAL DESCRIPTION: The Auxiliary Memory unit provides an extension of the main memory contained in the Digital Computer, it is possible that this memory could be also included in the computer when design is finalized.							
PHYSICAL DESCRIPTION: The Auxiliary Memory occupies an envelope of 9.6 x 8.1 x 5.8 inches, weighing approximately 20 pounds.							
TUG LOCATION: Forward Skirt		ACCESSIBILITY Adequate		LRU Yes			
LIFE DATA							
OPERATION LIFE: 3,400 Hrs      20      CYCLES			SHELF LIFE: Indefinite	MTBF 4,000 Hrs. (Design Goal)	MTBR 6,720 Hrs.		
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5		SPARES REQUIRED: TBD			
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE  Condition - Monitoring
	X		X		X	X	
OFI REQUIREMENTS: Same as item 118							
MAINTENANCE FUNCTIONS: Same as item 118							
OTHER CONSIDERATIONS/REMARKS  None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION:				TABLE 5-1 REF:		FUNCTION NO.	
Computer, Data & Orbiter Interface Units				Items 130-132		2.10, 2.11, 3.1 & 4.43	
SYSTEM:		SUBSYSTEM:		CRITICALITY:			
Avionics		Data Management		4			
FUNCTIONAL DESCRIPTION: Provides formal computer input/output functions between the Digital Computer and all other subsystems on the Tug, as well as performing other data conditioning functions such as D/A and A/D conversion.							
PHYSICAL DESCRIPTION: The interface units will occupy an envelope of 9.9 x 5 x 13.9 inches, weighing approximately 5 pounds							
TUG LOCATION:		ACCESSIBILITY			LRU		
Forward Skirt & Intertank		Adequate			Yes		
LIFE DATA							
OPERATION LIFE:			SHELF LIFE:		MTBF	MTBR	
3,400 Hrs. TIME 20 CYCLES			Indefinite		4,000 Hrs. (Design Goal)	6,720 Hrs.	
NO. TIMES REFURBISHABLE		ANTICIPATED REFURB/100 FLIGHTS			SPARES REQUIRED:		
18		2.5			TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	X		X		X	X	
OFI REQUIREMENTS:							
Same as item 118							
MAINTENANCE FUNCTIONS:							
Same as item 118							
OTHER CONSIDERATIONS/REMARKS							
None							



## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Tape Recorder				TABLE 5-1 REF: Item 133		FUNCTION NO. 2.10, 2.11, 3.1 & 4.43	
SYSTEM: Avionics		SUBSYSTEM: Data Management			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides permanent recording capability for flight OFI data.							
PHYSICAL DESCRIPTION: The tape recorder occupies an envelope of 9.6 x 7.9 x 5.8 inches, weighing approximately 12.5 pounds.							
TUG LOCATION: Forward Skirt		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES				SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)	
						MTBR 6,720 Hrs.	
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition - Monitoring
	X		X		X	X	
OFI REQUIREMENTS: Same as item 118							
MAINTENANCE FUNCTIONS: Same as item 118							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION:				TABLE 5-1 REF:		FUNCTION NO.	
Buffer/Formatter				Item 134		2.10, 2.11, 3.1 & 4.43	
SYSTEM:		SUBSYSTEM:		CRITICALITY:			
Avionics		Data Management		4			
FUNCTIONAL DESCRIPTION: Provides data conditioning from the Digital Computer to the Tape Recorder and the Communications subsystem, this includes proper formatting prior to recording and transmission.							
PHYSICAL DESCRIPTION: The Buffer/Formatter occupies an envelope of 9.9 x 5 x 13.9 inches, weighing approximately 10 pounds.							
TUG LOCATION:		ACCESSIBILITY		LRU			
Forward Skirt		Adequate		Yes			
LIFE DATA							
OPERATION LIFE:			SHELF LIFE:	MTBF	MTBR		
3,400 Hrs. TIME 20 CYCLES			Indefinite	4,000 Hrs. (Design Goal)	6,720 Hrs.		
NO. TIMES REFURBISHABLE		ANTICIPATED REFURB/100 FLIGHTS		SPARES REQUIRED:			
18		2.5		TBD			
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	X		X		X	X	
OFI REQUIREMENTS:							
Same as item 118							
MAINTENANCE FUNCTIONS:							
Same as item 118							
OTHER CONSIDERATIONS/REMARKS							
None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Airborne Electronically Steerable Microwave Phased Array (AESPA)				TABLE 5-1 REF: Item 136		FUNCTION NO. 2.10, 2.11, 3.1 & 4.44	
SYSTEM: Avionics		SUBSYSTEM: Communications			CRITICALITY: 3		
FUNCTIONAL DESCRIPTION: The AESPA is a integrated S-Band communications and tracking system that combines the functions of transmitting and receiving to and from the Tug. This system includes all equipment to perform the aforementioned functions.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Forward Skirt		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES				SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)	
						MTBR 6,720 Hrs.	
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE  Condition - Monitoring
	X		X		X	X	
OFI REQUIREMENTS: Same as item 118							
MAINTENANCE FUNCTIONS: Same as item 118							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION:				TABLE 5-1 REF:		FUNCTION NO.	
Command Decoder				Item 137		2.10, 2.11, 3.1 & 4.44	
SYSTEM:		SUBSYSTEM:			CRITICALITY:		
Avionics		Communications			3		
FUNCTIONAL DESCRIPTION: Provides the primary interface and signal conditioning of ground commands prior to transfer to the other Tug subsystems or the Digital computer input/output units							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION:			ACCESSIBILITY			LRU	
Forward Skirt			Adequate			Yes	
LIFE DATA							
OPERATION LIFE:				SHELF LIFE:		MTBF	
3,400 Hrs. TIME 20 CYCLES				Indefinite		4,000 Hrs. (Design Goal)	
MTBR				6,720 Hrs.			
NO. TIMES REFURBISHABLE			ANTICIPATED REFURB/100 FLIGHTS			SPARES REQUIRED:	
18			2.5			TBD	
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	X	X			X	X	
OFI REQUIREMENTS:							
Same as item 118							
MAINTENANCE FUNCTIONS:							
1. SCHEDULED MAINTENANCE (LEVEL I) <ul style="list-style-type: none"> <li>a. Review flight OFI data to determine if a failure or performance degradation has occurred.</li> <li>b. Perform system functional test and calibration.</li> </ul> 2. UNSCHEDULED MAINTENANCE (LEVEL I) <ul style="list-style-type: none"> <li>a. Remove and replace the failed unit if the OFI or Test/Calibration data indicates a failure or performance degradation, perform system functional test and calibration.</li> </ul> 3. UNSCHEDULED MAINTENANCE (LEVEL II) <ul style="list-style-type: none"> <li>a. Repair as applicable, test/calibrate and return to storage.</li> </ul>							
OTHER CONSIDERATIONS/REMARKS							
None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Television Camera				TABLE 5-1 REF: Item 139		FUNCTION NO. 2.10, 2.11, 3.1 & 4.22	
SYSTEM: Avionics		SUBSYSTEM: Communications			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides a backup remote controlled rendezvous and docking system in the event of a laser radar system failure.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Forward Skirt		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 Hrs. TIME 20 CYCLES				SHELF LIFE: Indefinite		MTBF 4,000 Hrs. (Design Goal)	
						MTBR 6,720 Hrs.	
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition - Monitoring
	X	X			X	X	
OFI REQUIREMENTS:  Same as item 118							
MAINTENANCE FUNCTIONS:  Same as item 137							
OTHER CONSIDERATIONS/REMARKS  None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION:				TABLE 5-1 REF:		FUNCTION NO.	
Television Electronics				Item 140		2.10, 2.11, 3.1 & 4.22	
SYSTEM:		SUBSYSTEM:			CRITICALITY:		
Avionics		Communications			4		
FUNCTIONAL DESCRIPTION: Provides control and processing circuits for the television camera.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION:		ACCESSIBILITY			LRU		
Forward Skirt		Adequate			Yes		
LIFE DATA							
OPERATION LIFE:			SHELF LIFE:		MTBF		MTBR
3,400 Hrs. TIME 20 CYCLES			Indefinite		4,000 Hrs. (Design Goal)		6,720 Hrs.
NO. TIMES REFURBISHABLE		ANTICIPATED REFURB/100 FLIGHTS			SPARES REQUIRED:		
18		2.5			TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE
	X	X			X	X	
OFI REQUIREMENTS:							
Same as item 118							
MAINTENANCE FUNCTIONS:							
Same as item 137							
OTHER CONSIDERATIONS/REMARKS							
None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

<b>MAINTENANCE ITEM DATA</b>							
ITEM IDENTIFICATION: Signal Conditioner				TABLE 5-1 REF: Item 142		FUNCTION NO. 2.10, 2.11, 3.1 & 4.21	
SYSTEM: Avionics		SUBSYSTEM: Measurement			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Processes low level signals from measuring sensors before entry into the DIU							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Fwd Skirt/In' rtank/ Aft Skirt		ACCESSIBILITY Adequate			LRU Yes		
<b>LIFE DATA</b>							
OPERATION LIFE: Indefinite TIME 20 CYCLES			SHELF LIFE: Indefinite		MTBF TBD	MTBR N/A - non repairable	
NO. TIMES REFURBISHABLE N/A		ANTICIPATED REFURB/100 FLIGHTS N/A			SPARES REQUIRED: 1 Ship Set		
<b>MAINTENANCE DATA</b>							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition-monitoring
	x				x	x	
OFI REQUIREMENTS: Baseline defined OFI adequate							
MAINTENANCE FUNCTIONS: 1. Scheduled maintenance (Level I) a. Review OFI data (onboard tapes or ground telemetry data) and correlate with ground instrumentation checkout data for indication of failure or degradation. 2. Unscheduled maintenance (Level I) a. Remove and replace							
OTHER CONSIDERATIONS-REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA								
ITEM IDENTIFICATION: Measurement Sensors					TABLE 5-1 REF: Items 143 thru 151		FUNCTION NO. 2.10, 2.11, 3.1 & 4.21	
SYSTEM: Avionics			SUBSYSTEM: Measurement			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provide temperature, pressure, position, RPM, flowrate, voltage, liquid level, vibration and strain measurements.								
PHYSICAL DESCRIPTION: TBS								
TUG LOCATION: All			ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA								
OPERATION LIFE: Indefinite TIME 20 CYCLES				SHELF LIFE: Indefinite		MTBF TBD		
						MTBR Policy N/A - non repairable		
NO. TIMES REFURBISHABLE N/A			ANTICIPATED REFURB/100 FLIGHTS N/A			SPARES REQUIRED: 1 Ship Set each type sensor		
MAINTENANCE DATA								
MAINTENANCE LEVEL		I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition-monitoring
		x				x	x	
OFI REQUIREMENTS: Baseline defined OFI adequate.								
MAINTENANCE FUNCTIONS: <ol style="list-style-type: none"> <li>1. Scheduled maintenance (Level I) <ol style="list-style-type: none"> <li>a. Review OFI data (onboard tapes on ground telemetry data) and correlate with ground instrumentation checkout data for indication of failure or degradation.</li> </ol> </li> <li>2. Unscheduled maintenance (Level I) <ol style="list-style-type: none"> <li>a. Remove and replace.</li> </ol> </li> </ol>								
OTHER CONSIDERATIONS/REMARKS  None								



# TUG MAINTENANCE REQUIREMENTS DATA SHEET

<b>MAINTENANCE ITEM DATA</b>							
ITEM IDENTIFICATION: <b>Detectors</b>				TABLE 5-1 REF: Items 152 thru 156		FUNCTION NO. 2.10, 2.11, 3.1 & 4.21	
SYSTEM: <b>Avionics</b>		SUBSYSTEM: <b>Measurement</b>			CRITICALITY: <b>4</b>		
FUNCTIONAL DESCRIPTION: <b>Provide H<sub>2</sub>/O<sub>2</sub> leak detection, contamination detection, and gas analysis.</b>							
PHYSICAL DESCRIPTION:  <b>TBS</b>							
TUG LOCATION: <b>All</b>		ACCESSIBILITY <b>Adequate</b>			LRU <b>Yes</b>		
<b>LIFE DATA</b>							
OPERATION LIFE: <b>Indefinite TIME 20 CYCLES</b>			SHELF LIFE: <b>None</b>		MTBF <b>TBD</b>	MTBR <b>TBD</b>	
NO. TIMES REFURBISHABLE <b>TBD</b>		ANTICIPATED REFURB/100 FLIGHTS <b>TBD</b>			SPARES REQUIRED: <b>1 Ship Set each type detector</b>		
<b>MAINTENANCE DATA</b>							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE  <b>On-Condition</b>
	<b>x</b>		<b>x</b>		<b>x</b>	<b>x</b>	
OFL REQUIREMENTS:  <b>N/A</b>							
MAINTENANCE FUNCTIONS: <ol style="list-style-type: none"> <li>1. Scheduled maintenance (Level I) <ol style="list-style-type: none"> <li>a. Ground system checkout of detector operation and proper calibration.</li> <li>b. Recalibration as required</li> </ol> </li> <li>2. Unscheduled maintenance (Level I) <ol style="list-style-type: none"> <li>a. Remove and replace</li> <li>b. Return to vendor/depot for repair</li> </ol> </li> <li>3. Unscheduled maintenance (Level III) <ol style="list-style-type: none"> <li>a. Vendor/depot repair and return to site</li> </ol> </li> </ol>							
OTHER CONSIDERATIONS/REMARKS  <b>None</b>							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA									
ITEM IDENTIFICATION: Fuel Cell					TABLE 5-1 REF: Item 158		FUNCTION NO. 2.10, 2.11, 2.19, 3.1 & 4.39		
SYSTEM: Avionics			SUBSYSTEM: Electrical Power and Distribution			CRITICALITY: 4			
FUNCTIONAL DESCRIPTION: Provides electrical power generation									
PHYSICAL DESCRIPTION: 12" x 16" x 20", 125/56 pounds									
TUG LOCATION: Intertank			ACCESSIBILITY Adequate			LRU Yes			
LIFE DATA									
OPERATION LIFE: TBD TIME TBD CYCLES				SHELF LIFE: TBD		MTBF TBD		MTBR TBD	
NO. TIMES REFURBISHABLE TBD			ANTICIPATED REFURB/100 FLIGHTS TBD			SPARES REQUIRED: 1 Ship Set			
MAINTENANCE DATA									
MAINTENANCE LEVEL		I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition-monitoring	
		x		x		x	x		
OFI REQUIREMENTS: Baseline defined OFI adequate.									
MAINTENANCE FUNCTIONS: <ol style="list-style-type: none"> <li>1. Scheduled maintenance (Level I) <ol style="list-style-type: none"> <li>a. Review OFI data for indication of failure or operational degradation.</li> <li>b. Replace spent reactant/N<sub>2</sub>/coolant as required.</li> </ol> </li> <li>2. Unscheduled maintenance (Level I) <ol style="list-style-type: none"> <li>a. Remove and replace</li> <li>b. Return to vendor for repair</li> </ol> </li> <li>3. Unscheduled maintenance (Level III) <ol style="list-style-type: none"> <li>a. Vendor repair and return to site</li> </ol> </li> </ol>									
OTHER CONSIDERATIONS/REMARKS  None									

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION:  Battery				TABLE 5-1 REF:  Item 159		FUNCTION NO. 1.7, 2.10, 3.1, 4.99 & 5.7	
SYSTEM: Avionics		SUBSYSTEM: Electrical Power and Distribution			CRITICALITY:  4		
FUNCTIONAL DESCRIPTION: Supplements current requirements for motor loads and powers the fuel cells.							
PHYSICAL DESCRIPTION:  9" x 8" x 8", 20 pounds							
TUG LOCATION: Intertank		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: TBD TIME TBD CYCLES				SHELF LIFE: TBD		MTBF TBD	
						MTBR TBD	
NO. TIMES REFURBISHABLE TBD		ANTICIPATED REFURB/100 FLIGHTS TBD			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE  Condition-monitoring
	x				x	x	
OFI REQUIREMENTS:  Baseline defined OFI adequate							
MAINTENANCE FUNCTIONS: 1. Scheduled maintenance (Level I) a. Review OFI data for indication of failure or degradation. b. Replace electrolytic media as required. 2. Unscheduled maintenance (Level I) a. Remove and replace unserviceable battery.							
OTHER CONSIDERATIONS/REMARKS  None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Reactant Tanks				TABLE 5-1 REF: Item 160		FUNCTION NO. 1.14, 2.10, 2.19, 3.1 & 4.39	
SYSTEM: Avionics		SUBSYSTEM: Electrical Power and Distribution			CRITICALITY: 3		
FUNCTIONAL DESCRIPTION: Provides storage capability for LO <sub>2</sub> and LH <sub>2</sub> supply of reactants for the fuel cells.							
PHYSICAL DESCRIPTION:  TBS							
TUG LOCATION: Intertank		ACCESSIBILITY TBS			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 hrs      TIME      20      CYCLES			SHELF LIFE: Indefinite		MTBF 4,000 hrs (design goal)	MTBR 6,720 hrs	
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: 1 Ship Set		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE  Condition - Monitoring
	x				x	x	
OFI REQUIREMENTS:  Baseline define OFI adequate							
MAINTENANCE FUNCTIONS: 1. Scheduled Maintenance (Level I) <ul style="list-style-type: none"> <li>a. Review flight OFI data for evidence of overload or stress conditions.</li> <li>b. Visual inspection for evidence of leakage and structural damage.</li> </ul> 2. Unscheduled Maintenance (Level I) <ul style="list-style-type: none"> <li>a. Remove and replace damaged/failed unit.</li> </ul>							
OTHER CONSIDERATIONS/REMARKS  None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Power Processing Unit				TABLE 5-1 REF: Item 161		FUNCTION NO. 2.10, 2.11, 3.1 & 4.39	
SYSTEM: Avionics		SUBSYSTEM: Electrical Power and Distribution			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides power regulation at input to power bus							
PHYSICAL DESCRIPTION: The PPU occupies an envelope of 9 x 9 x 5 inches, weighing approximately 8 pounds							
TUG LOCATION: Intertank		ACCESSIBILITY Adequate			LRU Yes		
LIFE DATA							
OPERATION LIFE: 3,400 hrs TIME 20 CYCLES				SHELF LIFE: Indefinite		MTBF 4,000 hrs (Design goal)	
MTBR 6,720 hrs							
NO. TIMES REFURBISHABLE 18		ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: TBD		
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition-Monitoring
	x	x			x	x	
OFI REQUIREMENTS: Same as item 118							
MAINTENANCE FUNCTIONS: Same as item 137							
OTHER CONSIDERATIONS/REMARKS None							

## TUG MAINTENANCE REQUIREMENTS DATA SHEET

MAINTENANCE ITEM DATA							
ITEM IDENTIFICATION: Power Distributors				TABLE 5-1 REF: Items 162-166		FUNCTION NO. 2.10, 2.11, 3.1 & 4.39	
SYSTEM: Avionics		SUBSYSTEM: Electrical Power and Distribution			CRITICALITY: 4		
FUNCTIONAL DESCRIPTION: Provides selective switching, control and conditioning of power from main power bus to various Tug subsystems.							
PHYSICAL DESCRIPTION: TBS							
TUG LOCATION: Fwd Skirt and Intertank			ACCESSIBILITY Adequate			LRU Yes	
LIFE DATA							
OPERATION LIFE: 3,400 hrs TIME 20 CYCLES				SHELF LIFE: Indefinite		MTBF 4,000 hrs (Design goal)	
						MTBR 6,720 hrs	
NO. TIMES REFURBISHABLE 18			ANTICIPATED REFURB/100 FLIGHTS 2.5			SPARES REQUIRED: TBD	
MAINTENANCE DATA							
MAINTENANCE LEVEL	I	II	III	MAINTENANCE TYPE	SCHD	UNSCHD	PRIMARY TECHNIQUE Condition-Monitoring
	x	x			x	x	
OFI REQUIREMENTS: Same as item 118							
MAINTENANCE FUNCTIONS: Same as item 137							
OTHER CONSIDERATIONS/REMARKS None							

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